Sources with the BigML Dashboard

The BigML Team

Version 2.2
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About this Document

This document provides a comprehensive description of how BigML sources work. A BigML source is the basic building block to bring your data to BigML and configure how BigML will parse it. BigML sources are used to create datasets that can later be transformed into predictive models or used as input to batch processes.

To learn how to use the BigML Dashboard to create datasets read:
- Datasets with the BigML Dashboard. The BigML Team. June 2016. [5]

To learn how to use the BigML Dashboard to build supervised predictive models read:
- Classification and Regression with the BigML Dashboard. The BigML Team. June 2016. [3]

To learn how to use the BigML Dashboard to build unsupervised models read:
- Cluster Analysis with the BigML Dashboard. The BigML Team. June 2016. [4]
- Anomaly Detection with the BigML Dashboard. The BigML Team. June 2016. [1]
- Association Discovery with the BigML Dashboard. The BigML Team. June 2016. [2]
- Topic Modeling with the BigML Dashboard. The BigML Team. November 2016. [7]
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Introduction

BigML is consumable, programmable, and scalable Machine Learning software that helps solving Classification, Regression, Cluster Analysis, Anomaly Detection, and Association Discovery problems, using a number of patent-pending technologies.

BigML helps you address these problems end-to-end. That is, you can seamlessly transform data into actionable predictive models, and later use these models (either as remote services or locally embedded into your applications) to make predictions.

To be processed by BigML, your data need to be first in Machine Learning-Ready Format (see Section 1.1) and stored in a data source (a source for short). Basically, a source is a collection of instances of the entity that you want to model stored in tabular format in a computer file. Typically, in a source, each row represents one of the instances and each column represents a field of the entity (see Figure 1.6). Section 1.1 describes the structure BigML expects a source to have. There are different types and data formats of BigML sources. There are also different file formats that BigML can process. They are all covered in Chapter 2.

Every time a new source is brought to BigML, a corresponding BigML source is created. Section 1.2 gives you a first example of how to create a BigML source. BigML uses the icon in Figure 1.1 to represent a BigML source.

The main purpose of BigML sources is to make sure that BigML parses and interprets each instance in your source correctly. This can save you some time before proceeding with any modeling on your data that involves heavier computation. BigML analyzes the initial part of each source to automatically infer the type of each field. BigML accepts fields of type: numeric, categorical, date-time, text, and items. These types are explained in detail in Chapter 5. The BigML Dashboard lets you update each field type individually to fix those cases in which BigML does not recognize the type of a field correctly (see Section 6.11). The BigML Dashboard also allows you to configure many other settings to ensure that your sources are correctly parsed. Chapter 6 describes all the available settings.

BigML is able to ingest sources from three different origins:

- **Local Sources** that are accessible in your local computer. (See Chapter 7.)
- **Remote Sources** that can be accessed using different transfer protocols or configuring different cloud storage providers. (See Chapter 8.)
• **Inline Sources** that can be created using a simple editor provided by the BigML Dashboard. (See Chapter 9.)

The first tab of the BigML Dashboard’s main menu allows you to list all your available sources. When you first create an account at BigML, you will find a list of promotional BigML sources. (See [Figure 1.2.](#)) In this *source list view* (Figure 1.2), you can see, for each source, the **Type**, **Name**, **Age** (time since the BigML source was created), **Size**, and **Number of Datasets** that have been created using that BigML source.

![Figure 1.2: Source list view](#)

On the top right corner of the *source list view*, you can see the menu options shown on [Figure 1.3.](#)

![Figure 1.3: Menu options of the source list view](#)

These menu options perform the following operations (from right to left):

1. **Create a source from a local source** opens a file dialog that helps you browse files in your local drives. (See Chapter 7.)

2. **Create a source from a URL** opens a modal window that helps you input the URL of that BigML source to automatically download a remote source. (See Chapter 8.)

3. **Create a inline source** opens an editor where you can directly input or paste data into it. (See Chapter 9.)

4. **Cloud Storage Drop Down** helps you browse through previously configured cloud storage providers. (See Subsection 8.7.1.)

5. **Search** searches your sources by name.

By default, every time you start a new project, your list of sources will be empty. (See [Figure 1.4.](#))
BigML does not impose any limit on the number of sources you can have under an individual BigML account or project. In addition, there are no limits on either the number of instances or the number of fields per source, though there are some limits on the total size a source can have, as explained in Chapter 10.

Each BigML source has a Name, a Description, a Category, and Tags. These allow you to provide documentation, and can also be helpful when searching through your sources. More details are in Chapter 11.

A BigML source can be associated with a specific project. You can move a source between projects. To perform this operation, see Chapter 13. A source can also be deleted permanently from your account. (See Chapter 14.)

A BigML source is the first resource that you need to create to apply Machine Learning to your own data using BigML. The only direct operation you can perform on a BigML source is creating a BigML dataset. BigML makes a clear distinction between sources and datasets: BigML sources allow you to ensure that BigML correctly transfers, parses, and interprets the content in your data, while a BigML dataset is a structured version of your data with basic statistics computed for each field. The main purpose of BigML sources is, therefore, to give you configuration options to ensure that your data is being parsed correctly. For a detailed explanation of BigML datasets, read the Datasets with the BigML Dashboard document [5].

### 1.1 Machine Learning-Ready Format

A data source is in Machine Learning-ready (ML-ready) format when a collection of instances of the entity you want to model has been transformed into tabular format (see Figure 1.5), in order to solve a specific Machine Learning task (i.e., classification, regression, cluster analysis, anomaly detection, or association discovery).

To get your data in ML-ready format requires:

1. Selecting a modeling task appropriate to your needs.
2. Denormalizing, aggregating, pivoting, and other data wrangling tasks to generate a suitable “feature space” for your selected modeling task.
3. Using domain knowledge and Machine Learning expertise to generate additional features that help better represent the instances.
4. Choosing the right file format to store each type of feature into a field and each instance into a record using a tabular structure. Each row is used to represent one of the instances, and each column is used to represent a field that describes all the instances. Each field can be: numeric, categorical, text, items, or date-time. (See Chapter 5.)
By structuring your data into ML-ready format before uploading it to BigML, you will better prepared to maximize the BigML capabilities and discover more insightful patterns and build better predictive models.

1.2 Creating a First Source

Figure 1.6 shows an example of a source in ML-ready format. Each row represents a user of a cell phone service and each column is an attribute of each user. The data is structured to predict whether a user will be canceling her account (Churn?) given her current plan (Plan), the number of minutes used last month (Talk), the number of text messages sent last month (Text), the number of applications purchased last month (Purchases), the number of megabytes of data consumed last month (Data), and the current age of the user (Age). The source is a CSV (Comma Separated Values) file and, therefore, in the right format to be processed by BigML.

<table>
<thead>
<tr>
<th>Plan</th>
<th>Talk</th>
<th>Text</th>
<th>Purchases</th>
<th>Data</th>
<th>Age</th>
<th>Churn?</th>
</tr>
</thead>
<tbody>
<tr>
<td>family</td>
<td>148</td>
<td>72</td>
<td>0</td>
<td>33.6</td>
<td>50</td>
<td>TRUE</td>
</tr>
<tr>
<td>business</td>
<td>85</td>
<td>66</td>
<td>0</td>
<td>26.6</td>
<td>31</td>
<td>FALSE</td>
</tr>
<tr>
<td>business</td>
<td>83</td>
<td>64</td>
<td>0</td>
<td>23.3</td>
<td>32</td>
<td>TRUE</td>
</tr>
<tr>
<td>individual</td>
<td>9</td>
<td>66</td>
<td>94</td>
<td>28.1</td>
<td>21</td>
<td>FALSE</td>
</tr>
<tr>
<td>family</td>
<td>15</td>
<td>0</td>
<td>35.3</td>
<td>29</td>
<td>FALSE</td>
<td></td>
</tr>
<tr>
<td>individual</td>
<td>66</td>
<td>72</td>
<td>175</td>
<td>25.8</td>
<td>51</td>
<td>TRUE</td>
</tr>
<tr>
<td>business</td>
<td>0</td>
<td>0</td>
<td>30</td>
<td>32</td>
<td>TRUE</td>
<td></td>
</tr>
<tr>
<td>family</td>
<td>18</td>
<td>84</td>
<td>230</td>
<td>45.8</td>
<td>31</td>
<td>TRUE</td>
</tr>
<tr>
<td>individual</td>
<td>71</td>
<td>110</td>
<td>240</td>
<td>45.4</td>
<td>54</td>
<td>TRUE</td>
</tr>
<tr>
<td>family</td>
<td>59</td>
<td>64</td>
<td>27.4</td>
<td>40</td>
<td>FALSE</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1.5: Instances and fields in tabular format

Figure 1.6: An example of a CSV file

To bring the source in Figure 1.6 to BigML, you can just drag and drop the file containing it on top of the BigML Dashboard. You can also paste its content into the BigML inline editor (see Chapter 9). A new source in the source list view will be shown. (See Figure 1.7.)
BigML automatically assigns to each source a unique identifier, \texttt{source/id}, where \texttt{id} is a string of 24 alpha-numeric characters, e.g., \texttt{source/570c9ae884622c5ecb008cb6}. This special ID can be used to retrieve and refer to the source both via the BigML Dashboard and the BigML API.

Once you click on the newly created source, you will arrive at a new page whose URL matches with the assigned ID. You will see that BigML has parsed the source and automatically identified the type of each of its seven fields as shown in Figure 1.8.

Note: In a source view, BigML transposes rows and columns compared to your original data (compare Figure 1.6 and Figure 1.8). That is, each row is associated with one of the fields of your original data, and each column shows the corresponding values of an instance. It becomes much easier to navigate them using a web browser if they are arranged this way when sources contain hundreds or thousands of fields. A source view only shows the first 25 instances of your data. The main goal of this view is to help you quickly identify if BigML is parsing your data correctly.
Source Types and Formats

Every BigML source has a type and a format. The type specifies its structure, for instance, whether it’s a single or composite source. The format describes the type of data parsed to extract rows from, for example, it’s CSV data or image.

2.1 Source Types

A BigML source is one of the following types:

- **Single**: A source created from a single non-zip file, such as a CSV, ARFF, JSON or image file. If a zip file contains only one file, the source created from it is also a Single source.

- **Composite**: A collection of other sources. The sources inside a composite source are called component sources. Component sources could be any type. A composite source can be created from an archive file containing multiple files, such as a zip or tar file. The detailed description about composite sources are in Chapter 4.

- **Inline**: A source created from inline data sent in the JSON of the creation request.

2.2 Source Formats

Again, a source’s format tells what kind of data was parsed for extracting rows. To some extent, it’s related to the format of the file Chapter 3 that was used to create the source. A BigML source can have following formats:

- **Table**: A source extracting rows parsing CSV or JSON data.

- **ARFF**: A source extracting rows parsing ARFF data.

- **Excel**: A source extracting data from Microsoft Excel files and similar files in binary formats.

- **Image**: A source containing images. See more details in Section 2.4.

- **Table+Image**: A composite source that extracts its rows from a CSV or JSON component, which contains cells referencing images which were also included as components of the table+image composite. See more details in (Section 4.4).

- **Mixed**: A composite source that contains heterogeneous components, which have different sets of fields. For a mixed source, there is no predefined method to extract data homogeneously from them. Therefore a mixed source has no fields and can not create datasets.

- **Empty**: A composite source that is empty or contains only empty sources.
2.3 Open and Closed Sources

When a source is created, BigML tries automatically to figure out how to extract rows from the raw data. For instance, if the file is a CSV file, most of the time BigML will discover what columns and column types it has, and they will become the source’s fields.

Occasionally however, if BigML doesn’t get everything right, users can edit that metadata and adjust the definitions of the source’s fields until they are correct. Source is the only BigML resource that is initially mutable.

A source is open when it can be modified. All sources are initially created open.

A source can be changed from open to closed. For composite sources, this is done by performing the Close This Composite Source operation.

For a non-composite source (either single or inline source), it will be automatically closed when its dataset is created. When creating a dataset from a composite source, the composite source is automatically closed too.

For a composite source, the lock in its icon under “Type” column represents whether it is open or closed, as seen in the figure above. The open or closed status is also in the source’s description string.

Once a source has been closed, it cannot be modified anymore.

What if you want to change something in a closed source? You can clone it. Cloning a source creates a new and open source that shares the original underlying data. Cloning is quick and efficient. Because a cloned source is created as an open source, it can be modified again.

An open source can be cloned too.

2.4 Image Sources

Users can create sources using image files. Please refer to Chapter 3 to see the image file formats BigML supports.

When a source is created by a single image file, it’s a Single source with an “Image” format, or is simply called an image source. You can see this in the source list view:
Chapter 2. Source Types and Formats

Figure 2.2: An image source in the source list view

Please note the “image” format in the source’s description string above, and the “image” icon in the “Type” column:

Figure 2.3: The image icon to represent an image source

An image source has two fields, the image, with type image, and its filename, with type path.

You can see the image information in the source: filename, pixel dimension, and file size.

Figure 2.4: An image source

You can create composite sources using an image source. You can do this by clicking on the cloud action icon.

You cannot create a dataset using an image source. But you can clone and close image sources.

When a source is created by an archive file containing multiple images, such as a zip or tar file, it’s a Composite source, which is covered in Chapter 4.
File Formats

BigML can process many different files to accommodate users. The following subsections review the file formats accepted by BigML.

3.1 Comma-Separated Values

The CSV\(^1\) (Comma Separated Values) file format is a well-known format that has long been used for exchanging data between applications.

Your CSV files must conform to the following rules before creating a source in BigML:

- A CSV file uses plain text to store tabular data.
- In a CSV file, each line of the file is a record.
- Each record is usually separated by a comma (","), but other separators like the semi-colon (";"), the colon (":"), or the pipe "|", can also be used.
- Each record must contain exactly the same number of fields.
- Fields can be quoted using double quotes ("").
- Fields that contain commas (or the corresponding separator), double quotes, or line separators must be quoted.
- The character encoding must be UTF-8\(^2\).
- Optionally, a CSV file can use the first line as a header to provide the names of each field.

BigML automatically parses your CSV files and is capable of dealing with most variants of the above options. It also provides you with different configuration options. (See Chapter 6.)

3.2 ARFF

BigML also accepts ARFF\(^3\) (Attribute-Relation File Format) files. This type of file was first introduced by WEKA\(^4\). ARFF files basically come with a richer version of the header than a CSV file does which can define extra information about the type of the fields. An ARFF file separates its content into two sections: Header and Data. The header is used to define the name of the relation being modeled, the name of attributes, and their types. The data section contains the actual data using comma-separated values. (See Figure 3.1.)

\(^1\)https://tools.ietf.org/html/rfc4180
\(^2\)https://en.wikipedia.org/wiki/UTF-8
\(^3\)http://www.cs.waikato.ac.nz/ml/weka/arff.html
\(^4\)http://www.cs.waikato.ac.nz/ml/weka/
% Customer Churn Dataset
@RELATION Customers
@ATTRIBUTE Plan { 'family', 'business', 'individual'}
@ATTRIBUTE Talk NUMERIC
@ATTRIBUTE Text NUMERIC
@ATTRIBUTE Purchases NUMERIC
@ATTRIBUTE Data NUMERIC
@ATTRIBUTE Age NUMERIC
@ATTRIBUTE Churn? {TRUE, FALSE}
@DATA
family, 148, 72, 0, 33.6, 50, TRUE
business, 85, 66, 0, 26.6, 31, FALSE
business, 83, 64, 0, 23.3, 32, TRUE
individual, 9, 66, 94, 28.1, 21, FALSE
family, 15, 0, 0, 35.3, 29, FALSE
individual, 66, 72, 175, 28.8, 51, TRUE
business, 0, 0, 0, 30, 32, TRUE
family, 18, 84, 230, 45.6, 31, TRUE
individual, 71, 110, 240, 45.4, 54, TRUE
family, 59, 64, 0, 27.4, 40, FALSE

Figure 3.1: An example of an ARFF file
3.3 JSON

BigML sources can also be created using JSON data in one of the following two formats:

3.3.1 List of Lists

A top-level list of lists of atomic values, each one defining a row. (See Figure 3.2.)

3.3.2 List of Dictionaries

A top-level list of dictionaries, where each dictionary’s values represent the row values and the corresponding keys represent the column names as shown in Figure 3.3. The first dictionary defines the keys that will be selected.

```json
[  
  [
  [
   "family", 148, 72, 0, 33.6, 50, "TRUE"],  
  [
   "business", 85, 66, 0, 25.6, 31, "FALSE"],  
  [
   "business", 83, 64, 0, 23.3, 32, "TRUE"],  
  [
   "individual", 9, 66, 94, 28.1, 21, "FALSE"],  
  [
   "family", 15, 0, 0, 35.3, 29, "FALSE"],  
  [
   "individual", 66, 72, 175, 25.8, 51, "TRUE"],  
  [
   "business", 0, 0, 0, 30, 32, "TRUE"],  
  [
   "family", 18, 84, 290, 45.8, 31, "TRUE"],  
  [
   "individual", 71, 110, 240, 45.4, 54, "TRUE"],  
  [
   "family", 89, 64, 0, 27.4, 40, "FALSE"]
]
```

Figure 3.2: An example of a JSON source using a list of lists
Figure 3.3: An example of a JSON source using a list of dictionaries
3.4 Other File Formats

BigML can also process Microsoft Excel and Numbers for Mac files. These files are usually readable in their native formats, but occasionally experience parsing issues. We recommend exporting them to CSV format before importing them to BigML to better guarantee proper parsing.

3.5 Image

BigML accepts many formats of image files: jpg, png, gif, tiff, bmp, webp, cur, ico, pcx, psd, psb. More formats will be supported in the future.

Note: Only the first frame of an animated (multi-framed) gif file will be used for model training.

3.6 Compressed Formats

Users can save bandwidth and time by creating sources from compressed files. The files can be gzipped (.gz), compressed (.bz2), as well as zipped (.zip). BigML also supports compressed TAR archive files, such as .tar.gz, .tgz, .tar.bz2 and .tbz2.

When creating sources from compressed formats, if the archive contains only one file, a single source will be created. If the archive contains two or more files, a composite source will be created.
Composite Sources

A composite source is a collection of other sources, which are called component sources. Component sources can be any type (Section 2.1), they can be single sources, they can be composite sources as well. In other words, composite sources can be nested. A composite source can only be a component source if it's closed (See Section 2.3).

BigML uses the icon in Figure 4.1 to represent a BigML composite source.

![Figure 4.1: Composite source icon](image)

You can see the composite source icons in the “Type” column under the source list view:

![Figure 4.2: Composite sources under the source list view](image)

The open/closed lock in the icons of composite sources signifies their open/closed status.
Chapter 4. Composite Sources

Figure 4.3: Icons for open and closed composite sources

When all the component sources of a composite source have the same fields, the composite source will inherit those fields, and a dataset can be created from it. The result will just be the concatenation of all the rows extracted from each component source inside the composite source. For instance, a composite source may have several CSV component sources, which were created from several CSV files with exactly the same fields, and the composite source will inherit those fields and behave like a single source.

A composite source is created open (Section 2.3), so is any other source. Being open means it's modifiable. The following operations can be performed to an open composite source:

- Add component sources.
- Remove component sources.
- Replace the full list of component sources with a new list.

A source can belong to as many composite sources as desired. However, when a source belongs to one or more composite sources, it cannot be modified, regardless of whether it is open or closed. This way all composite sources see the same version of the source all the time.

When adding or removing component sources to a composite source, it will check the compatibility of the fields of all its component sources, and update its own set of fields.

Once a composite source’s components are finalized and it must be closed to create datasets. When closing a composite source, all its component sources will be automatically closed.

You may create a dataset from an open composite source, but the composite source will be closed at the same time.

Unlike all other types of sources, composite sources must be explicitly closed by an API call or UI action. This is mainly to avoid accidentally closing a composite source by mistake. For instance, since composite sources can have a huge number of component sources, they may be shared and worked on by several collaborators. Then the mistake of accidentally closing the component sources would be costly.

To close a composite source, click on the CLOSE THIS COMPOSITE SOURCE menu item, either from the source’s context menu in a source list view.
Chapter 4. Composite Sources

4.1 Creating Composite Sources From Existing Sources

A composite source can be created by combining existing sources.

Under the source list view, there is a “Create composite source” icon on the source action bar:

Note: BigML currently limits the number of component sources in a composite source to 445,000. In other words, a composite source can have at most 445,000 components.
Section 4.2: Composite Sources

Clicking on it will bring the Composite source creation view:

![Composite source creation view](image)

Users can use the checkboxes to select the component sources, then clicking on the Create composite source button on top will bring the composite source creation confirmation box:

![Create composite source confirmation](image)

It lists the number of component sources and prompts users for the name of the composite source. Finish the creation by clicking on the Create button.
Remember: you can create a composite source with any number and any type of sources. However, only composite sources with homogeneous component sources, which mean they have the same format and exactly the same fields, can be used to create datasets.

4.2 Creating Composite Sources From Archive Files

Another way to create a composite source is by uploading an archive file, such as zip or tar, that contains more than one files. BigML supports a range of archive formats (See Chapter 3).

When an archive file of multiple files is uploaded, BigML will automatically create one source for each file inside the archive, and put them all together in a composite source. See the composite sources created by uploading archive files below:

![Composite sources created by archive files](image)

4.3 Image Composite Sources

When the component sources of a composite source are all image sources (See Section 2.4), that is, they all have the format “Image” (See Section 2.2), the composite source will also have the format “Image”. This is an image composite source.

An image composite source represents a collection of images and is more useful in machine learning than a single image. While a single image can be used for prediction, a machine learning model is trained on a collection of images, not a single image. A dataset intended for image applications contains many images, with each image as an instance in the dataset.

While single image sources cannot be used to create dataset, image composite sources can. In the dataset created from an image composite source, every row will correspond to one of the images in the composite source, and have a column representing the image data (type image), a second column as its filename (type path), and a possible third column as its label.

Note: As stated before, BigML allows up to 445,000 components in a composite source. Hence an image composite source can have at most 445,000 images.
4.3.1 Automatic Image Labels

Image labels are important in machine learning, and especially they are indispensable in image classification. A common practice in the industry is to group images by folders, with the folder names being their labels. BigML accommodates such practice by providing automatic image labeling with folders.

When an image composite source is created by uploading an archive file, most of times, it will have three fixed fields plus a set of autogenerated image fields (See next section Subsection 4.3.2). The three fixed fields are inherited from the single image sources as follows:

- **image_id** is a field with optype *image* that contains the identifier of the corresponding single image source.
- **filename** is a field with optype *path* that contains the path inside of the archive file for each image file.
- **label** is a categorical field whose values are extracted from the filenames. More specifically, they correspond to the innermost directory segment of the filename.

For instance, the label is “foo” for “bar/baz/foo/image.jpg” or is missing for “another_image.png”.

The *label* field is omitted in the following cases:

- If BigML doesn’t detect any directory names in the filenames.
- If the source creation request is made via API and it includes the property *disable_autolabel* which is set to the Boolean value *true*.

Zip file grape-strawberry-dir.zip has two folders named grape and strawberry:

```
<table>
<thead>
<tr>
<th>Name</th>
<th>Length</th>
<th>Date</th>
<th>Time</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>grape-strawberry-dir.zip</td>
<td>0</td>
<td>11-19-2020</td>
<td>22:05</td>
<td>grape/</td>
</tr>
<tr>
<td></td>
<td>44691</td>
<td>01-04-2006</td>
<td>21:33</td>
<td>grape/092_0020.jpg</td>
</tr>
<tr>
<td></td>
<td>13527</td>
<td>01-04-2006</td>
<td>21:33</td>
<td>grape/092_0008.jpg</td>
</tr>
<tr>
<td></td>
<td>37413</td>
<td>02-18-2006</td>
<td>16:46</td>
<td>grape/092_0009.jpg</td>
</tr>
</tbody>
</table>
```

```
<table>
<thead>
<tr>
<th>Name</th>
<th>Length</th>
<th>Date</th>
<th>Time</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>11-19-2020</td>
<td>22:05</td>
<td>strawberry/</td>
</tr>
<tr>
<td></td>
<td>10378</td>
<td>06-17-2020</td>
<td>20:57</td>
<td>strawberry/image_0032.jpg</td>
</tr>
<tr>
<td></td>
<td>8912</td>
<td>06-17-2020</td>
<td>20:57</td>
<td>strawberry/image_0026.jpg</td>
</tr>
<tr>
<td></td>
<td>8717</td>
<td>06-17-2020</td>
<td>20:57</td>
<td>strawberry/image_0027.jpg</td>
</tr>
</tbody>
</table>
```

Each folder contains a number of images. Once this zip is uploaded to the BigML Dashboard, an image composite source will be created:
As shown, image labels will be automatically generated from their folder names.

### 4.3.2 Extracted Image Features

When an image composite source is created, BigML analyzes the images and automatically generate a set of numeric features for each image. Those features appear as new, added fields in the composite source. While those fields can be viewed in the source, their values cannot be changed because they are generated fields.
Figure 4.12: Extracted image features in a composite source

Image features are only generated for image composite sources, they are not generated for single image sources.

By default, BigML extracts 234 features per image, representing its histogram of gradients. You can see the number of fields in the description string under the source name:

Figure 4.13: Image feature fields in the description string

In total, BigML offers five sets of extracted image features:

- Dimensions
- Average pixels
- Level histogram
- Histogram of gradients
- Wavelet subbands
These features are all numeric values describing the structure and contents of the images in the composite source.

BigML also offers five pre-trained convolutional neural networks (CNNs):

- MobileNet
- MobileNetV2
- ResNet-18
- ResNet-50 (Available to customers of virtual private clouds and private deployments)
- Xception (Available to customers of virtual private clouds and private deployments)

Users can configure and select different combinations of image features in the Source Configuration Options (Chapter 6). Different configurations are reflected by the numbers of fields in the description strings under the source names:

Please see “Image Analysis” (Section 6.9) for the detailed explanation of image features and how to configure them.

By exposing those image features as explicit fields in your datasets, they can be used by all machine learning algorithms and models on the BigML platform, just as any other feature.

### 4.3.3 Image Composite Views

On the Dashboard, there are three views for an image composite source. When users click on an image composite source in the source list view, it enters fields view.
4.3.3.1 Fields View

A fields view lists all the fields in the composite source:

![Fields view of an image composite source](image.png)

As seen in the figure above, an image comes with two fields, with the following icons representing their types:

![Image field type](image.png)  ![Path field type](image.png)

When the images are organized by folders with the folder names intended as their labels (see Subsection 4.3.1), an image comes with three fields. In addition to the two fields “image_id” and “filename”, as shown above, whose respective types are *image* and *path*, it has a third field named “label”, which type is *categorical*.

![Fields view of an image composite source with a label field](image.png)

Users can preview all the fields, including the images by hovering the mouse over the image IDs:
By default, all fields of the extracted image features are hidden. That’s why only two image fields are shown in Figure 4.20. However, you can click on the “show image features” icon next to the search box as shown below:

Figure 4.21: Icon to click to show image feature fields

Then, you can preview all fields, including the image features. At this point, when all fields are shown, you can click on the same icon to hide the fields of image features.
This fields view of a composite source is equivalent to the source view of a non-composite source (Figure 1.8).

Again, in a fields view, BigML transposes rows and columns compared to the original data. That is, each row is associated with one of the fields of the original data, and each column shows the corresponding values of an instance. It becomes much easier to navigate them using a web browser if they are arranged this way when sources contain hundreds or thousands of fields.

A fields view only shows the first 25 instances of the data. The main goal of this view is to help quickly identify if BigML is parsing the data correctly.

Using the tabs on top of the field list, users can switch to other two views.
4.3.3.2 Sources View

A sources view lists all the component sources in a composite source:

It's essentially a source list view inside a composite source. Users can click on each component source to view its details. Besides viewing the information of component sources, users can select them to
perform the following operations in an open composite source:

- **Delete sources**: Delete the selected component sources. This will not only remove the component sources from the composite source, but also delete them from the platform permanently.

- **Exclude sources**: Exclude the selected component sources. This will exclude them from the composite source, but they will stay as individual sources on the platform and won’t be deleted.

- **Create composite**: Create a new composite source using the selected sources as its component sources.

For a closed composite source, users can only select component sources to perform **Create composite**.

When making selections, users can use the “Select all sources” checkbox on the top right to sell all component sources. They can also use the “Search by name” box which acts as a name filter. That is, when a text string is typed into the box, all component sources whose name contain the string are shown and are for selection.
4.3.3.3 Images View

An images view shows all the images in the composite source.
For a **closed** image composite source, users can only view images, and they can load new images by clicking on the **Get new preview** button on the bottom right.
Figure 4.28: Images view of a closed image composite source

In the images view of an open image composite source, besides viewing all images, users can select them to perform certain operations. When making selections, users can use the “Select all images” checkbox on the top right to select all images. They can also use the “Search by name” box which acts as a name filter. That is, when a text string is typed into the box, all images whose name contain the string are shown and are for selection.
After the selection of images, the following operations can be performed to them:

- **Delete images**: Delete the selected images. This will not only remove the images from the composite source, but also delete them from the platform permanently.

- **Exclude images**: Exclude the selected images. This will exclude them from the composite source, but they will stay as individual image sources on the platform and won’t be deleted.

- **Create composite**: Create a new composite source using the selected images as its component sources.

- **Label images**: Give a label to the selected images.

When labeling images, there has to be a label field. When such field doesn’t exist, there will be a prompt to create one:

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**Figure 4.29: Filtering images by using name search**

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There are two ways to create a label field.

- First, on top of the images, on the left is a “Label field” textbox. Clicking on the “+” next to it, users will be prompted with a dialog box asking for the field name and the field type:
After inputing the field name and selecting its type from the dropdown, click the Add button to create the label field.

When there are one or more labels in the composite source, clicking on the “x” next to the “Label field” textbox will remove them.

Users will get a modal box to confirm the removal:

• The second way to create a label field is, by following the link in the prompt Figure 4.30, using the Source Configuration Panel of the composite source.
As shown above, there is an Add new label field button above the field list. Clicking on it will add a new field at the bottom of the field list. This is especially useful in creating multiple labels. After entering field names and selection field types, users have to click on the Update button to save the changes.

After a label field is created, users can go to the images view, select images and label them by giving the label field a value, such as “grape” shown below:

Figure 4.34: Adding a field in source configuration
4.3.4 Importing Label Fields to Image Composites

Label fields can be added to image composites by importing them from CSV or JSON files. This is very useful as sometimes it's easier to enter labels in a different file or the labels are prepared separately from images in the business workflow. Moreover, additional label fields can provide more information about the images, such as captions, comments, geo-coordinates, which can be in the CSV or JSON files.

What CSV or JSON files do in such context is to provide information about the images in a table format, so here we call these files table files.

Importing label fields is basically a join operation, which combines rows from the image source and the table source. The join is based on a related field between the two sources, and the related field is the image filename or path.
Chapter 4. Composite Sources

Figure 4.36: The menu icon for importing label fields

From an image composite source, click on the **IMPORT LABEL FIELDS FROM A TABLE SOURCE** menu icon, as shown in Figure 4.36. The icon is composed of three rows, an arrow and a source, signifying a table adding to a source.

Figure 4.37: Import label fields from a table source

Then users are presented with the input panel, as show in Figure 4.37. This panel is for selecting the table source and the image path field.
As shown in Figure 4.38, clicking on the “Select a source” input box will bring up a dropdown list, which are all table sources available. Select the desired one from the list.

Figure 4.39: Select the path field

Then select the path field in the table source that corresponds to the image path field in the current image composite source. Clicking on the input box will show the candidate field, after the selected table source was parsed.
After both selections were made, click on the Import label fields button to start the import. During the operation, there will be a progress bar along with relevant information (Figure 4.40).

After the operation is finished, the new label fields are shown in the Fields view of the composite source (Figure 4.41).

Note: if the current image composite source is closed, importing label fields to it from a table source
will create a new open image composite source, which will have the newly imported label fields. If the current image composite source is open, the importing operation will add the newly imported label fields to the image composite source and keep it open.

After the new label fields are imported, users can inspect them in the **Images view** of the composite source. As shown in Figure 4.42, different label fields can be selected by using the dropdown list of the “Label field” on top. They will show up in the image captions.

![Figure 4.42: Selecting different label fields to view](image)

### 4.4 Table+Image Composite Sources

Machine learning with images oftentimes requires labels of the images, especially in the applications of image classification. In many scenarios, images and their labels were prepared separately, so they appear in separate files. For instance, there is a collection of images while their labels is in a CSV or JSON file.

Besides labels, CSV or JSON files can provide other information of the images, such as captions, comments, geo-coordinates, etc.
What CSV or JSON files do in such context is to provide information about the images in a table format, so here we call these files table files.

To accommodate this common practice of using a separate table file for image labels and other information, BigML provides two solutions. The first one is that users can upload the images and the table file separately. Then users can import all label fields in the table file to the image composite source. This is covered in Subsection 4.3.4.

Another solution is by using composite sources of format “Table+Image”. As implied by the name of the format, there are two parts in the data. One is a collection of images, another a table file that is a CSV or JSON file. The ultimate goal of such format is to create datasets that include the images and the fields of the CSV. In the case when a JSON is used, it is to create datasets that include the images and the lists or dictionaries of the JSON.

By using “Table+Image” composite sources, users don’t have to upload the images and the table file separately. They don’t need to preform the importing operation, and they can create datasets from “Table+Image” composite sources.

As described in Section 4.2, a composite source can be created by uploading an archived collection of files. When the archive contains a list of images and a table file, the resulting composite will have the format “Table+Image”.

The components of the composite source created from images and a table file will have different fields, with the image sources having only image fields while the CSV or JSON source having other fields including labels.

Strictly speaking, such “Table+Image” composite source is heterogeneous, which means not all component sources have uniformly the same fields, hence it could be of the “mixed” format (Section 2.2). Instead, BigML recognizes that this is a table plus images, with the CSV or JSON providing tabular data, and essentially setting the fields of the composite source to those of the CSV or JSON. Additionally, attached to each row are the auto-generated fields of the extracted features from the images (Subsection 4.3.2).

The component source from the CSV or JSON in the “Table+Image” composite source is also called the table component. It is expected that one or more columns of the table component refer to an image. Those columns will become fields in the composite source and have the optype path, which contain the (relative) file name of the corresponding image, as extracted from the zip file index. BigML tries to discover which fields in the table component refer to images using the following heuristics:

- The field is named “file”, “filename”, “file name”, “path” or “image”, possibly by punctuation (/,-, _, or blank) and a number (e.g. “path 3”, “image/2”).
- The preview of the field contains values also found in the preview of the filenames extracted from the images.

In the rare cases of BigML not recognizing the path field properly, users can go to the source configuration, and update the optype of the intended field to path.

Here is a simple example, which is a zip file containing 6 files:

<table>
<thead>
<tr>
<th>Archive: images.zip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>78</td>
</tr>
<tr>
<td>15980</td>
</tr>
<tr>
<td>51886</td>
</tr>
<tr>
<td>38361</td>
</tr>
<tr>
<td>17700</td>
</tr>
<tr>
<td>55866</td>
</tr>
<tr>
<td>179861</td>
</tr>
</tbody>
</table>

There are 5 images file and a CSV which looks like:
Once the zip file is uploaded to the BigML Dashboard, a “Table+Image” composite source is created:

Figure 4.43: A composite source in Table+Image format

As seen in Figure 4.43 above, there are not only image path, image id and extracted image features as fields in the composite source, but also the “label” field which was from the CSV.

The uploading of the zip file above and the subsequent creation of its dataset is essentially equivalent to the following operations combined:

1. Upload the CSV and create a source;
2. Upload the images and create an image composite source;
3. Create datasets from the two sources, respectively;
4. Perform a dataset join by the column “image” in the CSV resulted dataset and the field “image” in the image dataset.

4.4.1 Views of Table+Image Composite Sources

Just like “Image” composite sources, “Table+Image” composite sources also have three views.

The fields view lists all the fields in the sources, that are the fields from the images, which includes at least the image field and the path field, as well as the fields from the table source, such as from a CSV.
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Figure 4.44: The fields view of a Table+Image composite source

As seen above, the fields view shows the image field and the path field from the images, and the categorical field called “label” from the table source.

Optionally, users can click on the “show image features” icon next to the search box to show all image features in the view.

The sources view list all component sources, including the table component, which is a CSV file in the example below.

Figure 4.45: The sources view of a Table+Image composite source

The images view of a “Table+Image” composite is different from that of a “Image” composite. For an
“Image” composite source, users can preview images, add and edit labels in its images view. But in the images view of a “Table+Image” composite source, users can only preview images.

Figure 4.46: The images view of a Table+Image composite source

4.4.2 Convert Table+Image Composites to Editable Image Composites

Users can convert a “Table+Image” composite source to an “Image” composite source, which becomes editable. Under any view of a “Table+Image” composite source, move over the cloud action icon on the right of the source title, then click on the menu item CONVERT TO EDITABLE COMPOSITE
A new “Image” composite source is then created, adding “editable” to its original title as the default new title.

In the new “Image” composite source, all fields from the table source become label fields. It contains all image sources as its component sources, and the total number of component sources is reduced by 1 comparing to the original “Table+Image” composite source – the table source is gone.
Chapter 4. Composite Sources

4.5 Merging Image Composite Sources

As stated in the beginning of the chapter, a composite source can be created from closed composite sources. For creating a composite from any existing sources, please see Section 4.1. A good application of this is to merge image composite sources. Here, “merge” refers to the concatenation of all the rows from each component source inside the created composite source.

For instance, images are labeled separately sometimes. One class of images were processed and uploaded to the BigML platform. Then another class of images were uploaded. They need to be merged to create datasets for machine learning.

When creating a composite source, the component sources should have the same fields, in other words...
they are homogeneous, so that the composite source can inherit all fields, the same as each component source. This maintains the “format” of the composite source (Section 2.2).

If the component sources don’t have the same fields, or they are heterogeneous, the resulting composite source will have “Mixed” format, which cannot be used to create datasets.

Therefore, when merging image composite sources, it is very important to make sure that they have identical fields.

To create a composite source from existing composite source, use the Create composite source button on the action bar in the source list view as shown below.

![Figure 4.50: Creating a new composite source](image1)

Next, select the component sources by using the checkboxes next to them. In this case, select the existing image composite sources for the purpose of merging them.

![Figure 4.51: Selecting component sources](image2)

Then click on the Create composite source button to create the new composite source.
Source Fields

BigML will automatically classify the fields in your source into one of the types defined in the following subsections.

5.1 Numeric

Numeric fields are used to represent both integer and real numbers. Figure 5.1 shows the icon that BigML uses to refer to them.

![Figure 5.1: Numeric Field Icon](image)

5.2 Categorical

Categorical fields, also known as nominal fields, take a small number of pre-defined values or categories. The icon BigML uses to represent categorical fields is shown in Figure 5.2.

![Figure 5.2: Categorical Field Icon](image)

When BigML processes a field that only takes two values (like 0 or 1), it automatically assigns the type categorical to the field.

BigML has a limit of 1,000 categories for each categorical field. When BigML detects a field with more than 1,000 categories, it automatically changes the type to text. If you are interested in modeling more categories in only one field, consider a BigML Private Deployment that allows the number of categories to be upgraded to tens of thousands.

5.3 Date-Time

Date-time fields are used to represent machine-readable date/time information. The icon BigML uses to represent date-time fields is shown in Figure 5.3.

---

When BigML detects a date-time field, it expands it into additional fields with their numeric components. For date fields, *year*, *month*, *day*, and *day of the week* are generated. For time fields, *hour*, *minute*, and *second* are generated (see Figure 5.4). For fields that include both a date and time component, the seven fields above are generated. For example, the following CSV file has a date-time field named *Date* that will get expanded into the seven additional fields shown on Figure 5.5.

<table>
<thead>
<tr>
<th>Date</th>
<th>Open</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016-04-01</td>
<td>95.59</td>
</tr>
<tr>
<td>2016-03-31</td>
<td>97.1</td>
</tr>
<tr>
<td>2016-03-30</td>
<td>95.3</td>
</tr>
</tbody>
</table>

You can enable or disable automatic generation by switching the *Expand date-time fields* setting in the *CONFIGURE SOURCE* menu option. (See Chapter 6.) When disabled, potential date-time fields will be treated as either categorical or text fields.

By default, BigML accepts date and times that follow the ISO 8601 standard. BigML also recognizes the formats listed on Table 5.1.

---

**Table 5.1: Extra date-time formats recognized by BigML**

<table>
<thead>
<tr>
<th>Name</th>
<th>Example</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>basic-date-time</td>
<td>19690714T173639.592Z</td>
<td>YYYYMMdd'T'HHmmss.SSSX</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Field Type</th>
<th>Format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>basic-date-time-no-ms</td>
<td>19690714T173639Z</td>
<td>YYYYMMdd</td>
</tr>
<tr>
<td>basic-iso-date</td>
<td>19690714Z</td>
<td>YYYYMMddXX</td>
</tr>
<tr>
<td>basic-ordinal-date-time</td>
<td>1969195T173639.592Z</td>
<td>YYYYYDDD'T'HHmmss.SSSXX</td>
</tr>
<tr>
<td>basic-ordinal-date-time-no-ms</td>
<td>1969195T173639Z</td>
<td>YYYYYDDD'T'HHmmssXX</td>
</tr>
<tr>
<td>basic-t-time</td>
<td>T173639.592Z</td>
<td>'T'HHmmss.SSSXX</td>
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<td>basic-t-time-no-ms</td>
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<td>'T'HHmmssXX</td>
</tr>
<tr>
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<td>HHmmssXX</td>
</tr>
<tr>
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<td>173639Z</td>
<td>HHmmssXX</td>
</tr>
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<td>1969W291</td>
<td>xxxx'W'wwe</td>
</tr>
<tr>
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<td>xxxx'W'wwe'T'HHmmss.SSSXX</td>
</tr>
<tr>
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<td>xxxx'W'wwe'T'HHmmssXX</td>
</tr>
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<td>bigquery</td>
<td>1969-07-14 17:36:39Z</td>
<td>Y-M-d H:m:sXXX</td>
</tr>
<tr>
<td>bigquery-alt</td>
<td>1969-07-14 17:36:39 UTC</td>
<td>Y-M-d H:m:s z</td>
</tr>
<tr>
<td>bigquery-alt-millisecond</td>
<td>1969-7-14 17:36:392000 UTC</td>
<td>Y-M-d H:m:ssSSS</td>
</tr>
<tr>
<td>bigquery-millisecond</td>
<td>1969-7-14 17:36:392000Z</td>
<td>Y-M-d H:m:ssSSSSXXX</td>
</tr>
<tr>
<td>clock-minute</td>
<td>5:36 PM</td>
<td>h:m a</td>
</tr>
<tr>
<td>clock-minute-nospace</td>
<td>5:36PM</td>
<td>h:ma</td>
</tr>
<tr>
<td>clock-second</td>
<td>5:36:39 PM</td>
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<tr>
<td>date-hour</td>
<td>1969-07-14T17</td>
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</tr>
<tr>
<td>date-hour-minute</td>
<td>1969-07-14T17:36</td>
<td>YYYY-MM-dd'T'H:mm</td>
</tr>
<tr>
<td>date-hour-minute-second</td>
<td>1969-07-14T17:36:39</td>
<td>YYYY-MM-dd'T'H:mm:ss</td>
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<tr>
<td>date-hour-minute-second-ms</td>
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<td>YYYY-MM-dd'T'HH:mm:ss.SSS</td>
</tr>
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<td>date-hour-minute-with-solidus</td>
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<td>YYYY/MM/dd'T'H:mm</td>
</tr>
<tr>
<td>date-hour-with-solidus</td>
<td>1969/07/14T17</td>
<td>YYYY/MM/dd'T'H</td>
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<td>date-time-no-ms</td>
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<td>YYYY-MM-dd'T'H:mm:ssXXX</td>
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<td>d/M/Y</td>
</tr>
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<td>Field Type</td>
<td>Format</td>
<td>Example</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------</td>
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</tr>
<tr>
<td><code>eu-date-clock-minute</code></td>
<td>14/7/1969 5:36 PM</td>
<td><code>d/M/Y h:m a</code></td>
</tr>
<tr>
<td><code>eu-date-clock-minuteno-space</code></td>
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</tr>
<tr>
<td><code>eu-date-clock-second</code></td>
<td>14/7/1969 5:36:39 PM</td>
<td><code>d/M/Y h:m:s a</code></td>
</tr>
<tr>
<td><code>eu-date-clock-second-no-space</code></td>
<td>14/7/1969 5:36PM</td>
<td><code>d/M/Y h:m:sa</code></td>
</tr>
<tr>
<td><code>eu-date-millisecond</code></td>
<td>14/7/1969 17:36:39.592</td>
<td><code>d/M/Y H:m:s.SSS</code></td>
</tr>
<tr>
<td><code>eu-date-minute</code></td>
<td>14/7/1969 17:36</td>
<td><code>d/M/Y H:m</code></td>
</tr>
<tr>
<td><code>eu-date-second</code></td>
<td>14/7/1969 17:36:39</td>
<td><code>d/M/Y H:m:s</code></td>
</tr>
<tr>
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<td>14.7.1969</td>
<td><code>d.M.Y</code></td>
</tr>
<tr>
<td><code>eu-ddate-clock-minute</code></td>
<td>14.7.1969 5:36 PM</td>
<td><code>d.M.Y h:m a</code></td>
</tr>
<tr>
<td><code>eu-ddate-clock-minuteno-space</code></td>
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<td><code>d.M.Y h:ma</code></td>
</tr>
<tr>
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<td><code>d.M.Y h:m:s a</code></td>
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<td><code>d.M.Y h:m:sa</code></td>
</tr>
<tr>
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<td><code>d-M-Y</code></td>
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<td><code>d-M-Y h:ma</code></td>
</tr>
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<tr>
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<td><code>d-M-Y h:m:sa</code></td>
</tr>
<tr>
<td><code>iso-date</code></td>
<td>1969-07-14Z</td>
<td><code>Y-M-dXXX</code></td>
</tr>
<tr>
<td><code>iso-date-time</code></td>
<td>1969-07-14T17:36:39.592Z</td>
<td><code>Y-M-d'&quot;T&quot;HH:mm:ss.SSSXXX</code></td>
</tr>
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<td>1969-07-14</td>
<td><code>Y-M-d</code></td>
</tr>
<tr>
<td><code>iso-local-time</code></td>
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<td><code>HH:mm:ss.SSS</code></td>
</tr>
<tr>
<td><code>iso-offset-date</code></td>
<td>1969-07-14Z</td>
<td><code>Y-M-dXXX</code></td>
</tr>
<tr>
<td><code>iso-offset-time</code></td>
<td>17:36:39.592Z</td>
<td><code>HH:mm:ss.SSSXXX</code></td>
</tr>
<tr>
<td><code>iso-ordinal-date</code></td>
<td>1969-195Z</td>
<td><code>YYYY-DDDXXX</code></td>
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### Chapter 5. Source Fields

<table>
<thead>
<tr>
<th>Format</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>iso-time</td>
<td>17:36:39.592Z</td>
<td>HH:mm:ss.SSSXXX</td>
</tr>
<tr>
<td>iso-week-date</td>
<td>1969-W29-1Z</td>
<td>xxxx-'W'ww-e</td>
</tr>
<tr>
<td>mysql</td>
<td>1969-07-14 17:36:39</td>
<td>YYYY-MM-dd H:mm:ss</td>
</tr>
<tr>
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<td>1969-7-14 17:36</td>
<td>YYYY-MM-dd H:m</td>
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<td>odata-format</td>
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<td>EEE, dd MMM YYYY HH:mm:ss z</td>
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<tr>
<td>rfc822</td>
<td>Mon, 14 Jul 1969 17:36:39 +0000</td>
<td>EEE, dd MMM YYYY HH:mm:ss ZZZZ</td>
</tr>
<tr>
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<td>'T'HH:mm:ss.SSSXXX</td>
</tr>
<tr>
<td>t-time-no-ms</td>
<td>T17:36:39Z</td>
<td>'T'HH:mm:ss.xxx</td>
</tr>
<tr>
<td>time</td>
<td>17:36:39.592Z</td>
<td>HH:mm:ss.SSSXXX</td>
</tr>
<tr>
<td>time-no-ms</td>
<td>17:36:39Z</td>
<td>HH:mm:ss.xxx</td>
</tr>
<tr>
<td>timestamp</td>
<td>-14711000</td>
<td></td>
</tr>
<tr>
<td>timestamp-msecs</td>
<td>-14711000408</td>
<td></td>
</tr>
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<td>twitter-time</td>
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<td>E MMM d H:m:s Z Y</td>
</tr>
<tr>
<td>twitter-time-alt</td>
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<td>Y-M-d H:m:s Z</td>
</tr>
<tr>
<td>twitter-time-alt-2</td>
<td>1969-7-14 17:36 +0000</td>
<td>Y-M-d H:m Z</td>
</tr>
<tr>
<td>twitter-time-alt-3</td>
<td>Mon Jul 14 17:36 +0000 1969</td>
<td>E MMM d H:m Z Y</td>
</tr>
<tr>
<td>us-date</td>
<td>7/14/1969</td>
<td>M/d/Y</td>
</tr>
<tr>
<td>us-date-clock-minute</td>
<td>7/14/1969 5:36 PM</td>
<td>M/d/Y h:m a</td>
</tr>
<tr>
<td>us-date-clock-minute-nospace</td>
<td>7/14/1969 5:36PM</td>
<td>M/d/Y h:ma</td>
</tr>
<tr>
<td>us-date-clock-second</td>
<td>7/14/1969 5:36:39 PM</td>
<td>M/d/Y h:m:s a</td>
</tr>
<tr>
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<td>7/14/1969 5:36:39PM</td>
<td>M/d/Y h:m:s a</td>
</tr>
<tr>
<td>us-date-millisecond</td>
<td>7/14/1969 17:36:39.592</td>
<td>M/d/Y H:m:s.SSS</td>
</tr>
<tr>
<td>us-date-minute</td>
<td>7/14/1969 17:36</td>
<td>M/d/Y H:m</td>
</tr>
<tr>
<td>us-date-second</td>
<td>7/14/1969 17:36:39</td>
<td>M/d/Y H:m:s</td>
</tr>
<tr>
<td>us-sdate</td>
<td>7-14-1969</td>
<td>M-d-Y</td>
</tr>
<tr>
<td>us-sdate-clock-minute</td>
<td>7-14-1969 5:36 PM</td>
<td>M-d-Y h:m a</td>
</tr>
<tr>
<td>us-sdate-clock-minute-nospace</td>
<td>7-14-1969 5:36PM</td>
<td>M-d-Y h:ma</td>
</tr>
<tr>
<td>us-sdate-clock-second</td>
<td>7-14-1969 5:36:39 PM</td>
<td>M-d-Y h:m:s a</td>
</tr>
<tr>
<td>us-sdate-clock-second-nospace</td>
<td>7-14-1969 5:36:39PM</td>
<td>M-d-Y h:m:s a</td>
</tr>
<tr>
<td>us-sdate-millisecond</td>
<td>7-14-1969 17:36:39:592</td>
<td>M-d-Y H:m:s.SSS</td>
</tr>
<tr>
<td>us-sdate-minute</td>
<td>7-14-1969 17:36</td>
<td>M-d-Y H:m</td>
</tr>
<tr>
<td>us-sdate-second</td>
<td>7-14-1969 17:36:39</td>
<td>M-d-Y H:m:s</td>
</tr>
<tr>
<td>week-date</td>
<td>1969-W29-1</td>
<td>xxxx-'W'ww-e</td>
</tr>
<tr>
<td>week-date-time</td>
<td>1969-W29-1T17:36:39:592Z</td>
<td>xxxx-'W'ww-e'T'HH:mm:ss.SSSXXX</td>
</tr>
</tbody>
</table>

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Chapter 5. Source Fields

<table>
<thead>
<tr>
<th>Source Field</th>
<th>Format 1</th>
<th>Format 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>week-date-time-no-ms</td>
<td>1969-W29-1T17:36:39Z</td>
<td>xxxx-”W”w-“T”H:mm:ssXXX</td>
</tr>
<tr>
<td>weekyear-week</td>
<td>1969-W29</td>
<td>xxxx-”W”w</td>
</tr>
<tr>
<td>weekyear-week-day</td>
<td>1969-W29-1</td>
<td>xxxx-”W”w-e</td>
</tr>
<tr>
<td>year-month</td>
<td>1969-07</td>
<td>YYYY-MM</td>
</tr>
<tr>
<td>year-month-day</td>
<td>1969-07-14</td>
<td>YYYY-MM-dd</td>
</tr>
<tr>
<td>other</td>
<td>Define your own format</td>
<td></td>
</tr>
</tbody>
</table>

![Figure 5.6: A source with a date-time field expanded](image)

If your date-time field is not automatically recognized, you can configure your field and select the right format or input a custom format. See a detailed explanation in Subsection 6.11.1.

5.4 Text

Text fields (or string fields) are used to represent an arbitrary number of characters. Many Machine Learning algorithms are designed to work only with numeric and categorical fields and cannot easily handle text fields. BigML takes a basic and reliable approach, leveraging some basic Natural Language Processing (NLP) techniques along with a simple bag-of-words style method of feature generation to include text fields within its modeling framework.

Text fields are specially processed by BigML using the configuration options explained in Chapter 6.

First, BigML performs some basic language detection. BigML recognizes texts in Arabic, Catalan, Chinese, Czech, Danish, Dutch, English, Farsi/Persian, Finish, French, German, Hungarian, Italian, Japanese, Korean, Polish, Portuguese, Turkish, Romanian, Russian, Spanish, and Swedish. Please let the Support Team at BigML know if you want BigML to add your language.

---

3 https://en.wikipedia.org/wiki/Natural_language_processing
5 support@bigml.com
BigML can also perform case sensitive or insensitive analyses, remove stop words before processing the text, search for n-grams in the text, use some basic stemming, and apply different filters to your text fields. Finally, it can use different tokenization strategies. All these options are described in Chapter 6.

The icon that BigML uses to refer to text fields is shown on Figure 5.7.

![Text field icon](image)

**Figure 5.7: Text field icon**

**Figure 5.8** is an example of a CSV file with a text field. It has two fields: the first one is the text of a tweet directed to an airline, and the second one is a label that represents a sentiment (i.e., positive, negative, or neutral). If you create a source with that file, BigML will automatically assign the types **text** and **categorical** as shown on Figure 5.9.

<table>
<thead>
<tr>
<th>tweet</th>
<th>sentiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>@united is it on a flight now? Thanks for reply</td>
<td>neutral</td>
</tr>
<tr>
<td>@united Actually, the flight was just Cancelled, Flightled!</td>
<td>negative</td>
</tr>
<tr>
<td>@JetBlue going to San Juan</td>
<td>neutral</td>
</tr>
<tr>
<td>@united flights taking off from IAD this afternoon?</td>
<td>neutral</td>
</tr>
<tr>
<td>@JetBlue I LOVE JET BLUE!</td>
<td>positive</td>
</tr>
<tr>
<td>@JetBlue thanks. I appreciate your prompt response</td>
<td>positive</td>
</tr>
<tr>
<td>@united diverged to Burlington, Vermont. This sucks.</td>
<td>negative</td>
</tr>
<tr>
<td>@SouthwestAir and thx for not responding</td>
<td>negative</td>
</tr>
<tr>
<td>@AmericanAir @SouthwestAir - Y'all will like this one.</td>
<td></td>
</tr>
<tr>
<td>@USAirways you guys lost my luggage</td>
<td>negative</td>
</tr>
</tbody>
</table>

![CSV example](image)

**Figure 5.8: An excerpt of an example of a CSV file with a text field**

![Source example](image)

**Figure 5.9: An example of a source with a text field**

---


10[https://github.com/monkeylearn/sentiment-analysis-benchmark](https://github.com/monkeylearn/sentiment-analysis-benchmark)
5.5 Items

When a field contains an arbitrary number of items (categories or labels), BigML assigns the type `items` to it. Items are separated using a special separator that is configured independently of the CSV separator used to separate the rest of fields of the source. These types of fields are used mainly for association discovery.

The icon used by BigML to denote items fields is shown in Figure 5.10.

![Items field icon](image)

Figure 5.10: Items field icon

A source can have multiple fields with items each one using a different items separator. Figure 5.11 shows an example of sources with three items fields. The first two use the “;” (semicolon) as items separator, and the third one uses the “|” (pipe) as items separator. Figure 5.12 shows how BigML recognizes them after being configured, using the panel described in Chapter 6 to set up a different separator for each field.

<table>
<thead>
<tr>
<th>ID, Age, Gender, Marital Status, Certifications, Recommendations, Courses, Titles, Languages, Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 51, Female, Widowed, 5, 10, 3, Student; Manager, French; English, JSON; Perl; Python; Ruby; Oracle</td>
</tr>
<tr>
<td>2, 47, Male, Divorced, 5, 10, 6, Manager; CEO, English; German; Italian; MongoDB; Business Intelligence; Linux; Oracle</td>
</tr>
<tr>
<td>3, 19, Male, Married, 0, 0, 0, Student, French, MongoDB; JSON; Web programming</td>
</tr>
<tr>
<td>4, 45, Male, Divorced, 1, 5, 3, Engineer, German; English; Windows; MongoDB; Algorithm Design; MySQL; Linux</td>
</tr>
</tbody>
</table>

Figure 5.11: An excerpt of an example of a CSV file with three items fields
Chapter 5. Source Fields

5.6 Image

When images are recognized in the raw data, BigML will generate two fields for each image. One field is assigned as “image”, which is pointing to the normalized version of the original image. This is the icon that BigML uses to refer to them:

![image icon](image_icon.png)

Figure 5.13: Image field icon

Another field is its filename and is assigned as “path”. BigML uses this icon to refer to them:

![path icon](path_icon.png)

Figure 5.14: Path field icon

Images are normalized to a “maximum resolution” of 512x512, while holding the aspect ratio constant.

5.7 Regions

Regions fields are used to represent areas of interest in an image. They are typically used as the objective field in object detection models. Figure 5.15 shows the icon BigML uses to refer to them:

![regions icon](regions_icon.png)

Figure 5.15: Regions field icon
The values of a regions field can be specified either by a list of 5-tuples, or a list of JSON maps, also known as JSON objects.

The canonical form of a region is a 5-tuple, or a list of 5 elements. The first element is the class label, the rest are the coordinates of the bounding box. Specifically, this is a region:

\[
[\text{label} \ \text{xmin} \ \text{ymin} \ \text{xmax} \ \text{ymax}]
\]

so is this (commas are optional):

\[
[\text{label}, \ \text{xmin}, \ \text{ymin}, \ \text{xmax}, \ \text{ymax}]
\]

where label is the class to which the object belongs. (xmin ymin) are the coordinates of the top left vertex of the bounding box, (xmax ymax) the coordinates of the bottom right vertex.

For example, the following two represent the same region:

\[
[\text{"abc"} 10 \ 15 \ 36 \ 29] \\
[\text{"abc"}, 10, 15, 36, 29]
\]

Equivalently, a JSON map can be used to represent a region:

\[
\{\text{"label"} : \text{label}, \ \text{"xmin"} : \text{xmin}, \ \text{"ymin"} : \text{ymin}, \ \text{"xmax"} : \text{xmax}, \ \text{"ymax"} : \text{ymax}\}
\]

A JSON map representing a region may use any of these key collections:

1. \((\text{label}, \ \text{xmin}, \ \text{ymin}, \ \text{xmax}, \ \text{ymax})\) where \((\text{xmin}, \ \text{ymin})\) is the top left vertex of the region, while \((\text{xmax}, \ \text{ymax})\) the bottom right vertex. This is the canonical tuple representation. If no keys are used in a JSON map, the coordinates are assumed to be in this format.

2. \((\text{label}, \ \text{xmin}, \ \text{ymin}, \ \text{width}, \ \text{height})\) where \((\text{xmin}, \ \text{ymin})\) is the top left vertex of region, while \((\text{width}, \ \text{height})\) the width and height of the region, respectively.

3. \((\text{label}, \ \text{xmax}, \ \text{ymax}, \ \text{width}, \ \text{height})\) where \((\text{xmax}, \ \text{ymax})\) is the bottom right vertex of region, while \((\text{width}, \ \text{height})\) the width and height of the region, respectively.

4. \((\text{label}, \ \text{x}, \ \text{y}, \ \text{width}, \ \text{height})\) where \((\text{x}, \ \text{y})\) is the center of the region, while \((\text{width}, \ \text{height})\) the width and height of the region, respectively.

5. \((\text{label}, \ \text{xcenter}, \ \text{ycenter}, \ \text{width}, \ \text{height})\) which is a synonym of 4, with \text{xcenter} for \text{x} and \text{ycenter} for \text{y}.

As one image may contain more than one object, the value of its regions field is a list of 5-tuples, or a list of JSON maps. For instance, the following two JSON maps are equivalent for the annotation of one image (the backslash \ is the line continuation mark, meaning the two lines should be read as a single line):

\[
\{\text{"file"} : \text{"a.png"}, \ \text{"box"} : [\{\text{"cat"}, 20, 150, 250, 300]\}]
\]

\[
\{\text{"file"} : \text{"a.png"}, \ \text{"box"} : [\{\text{"label"} : \text{"cat"}, \ \text{"xmin"} : 20, \ \text{"ymin"} : 150, \ \text{"xmax"} : 250, \ \text{"ymax"} : 300\}]\}
\]

The same region can also be specified as:

\[
\{\text{"file"} : \text{"a.png"}, \ \text{"box"} : [\{\text{"label"} : \text{"cat"}, \ \text{"x"} : 135, \ \text{"y"} : 225, \ \text{"width"} : 230, \ \text{"height"} : 150\}]\}
\]

### 5.8 Field IDs

Each field is automatically assigned an ID in the form of a six-character hexadecimal number (e.g., "000001"). This ID can be used via the BigML API to retrieve and update the fields of a source. If you mouse over a field on the source view, you will see a tooltip with the corresponding ID of the field. (See Figure 5.16.)
<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Instance 1</th>
<th>Instance 2</th>
<th>Instance 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan</td>
<td>ABC</td>
<td>family</td>
<td>business</td>
<td>business</td>
</tr>
<tr>
<td>Talk</td>
<td>123</td>
<td></td>
<td>85</td>
<td>83</td>
</tr>
<tr>
<td>Text</td>
<td>123</td>
<td>72</td>
<td>86</td>
<td>64</td>
</tr>
<tr>
<td>Purchases</td>
<td>123</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Data</td>
<td>123</td>
<td>33.6</td>
<td>26.6</td>
<td>23.3</td>
</tr>
<tr>
<td>Age</td>
<td>123</td>
<td>50</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td>Churn?</td>
<td>ABC</td>
<td>TRUE</td>
<td>FALSE</td>
<td>TRUE</td>
</tr>
</tbody>
</table>

This field is Numeric and its API id is "0000001"

Figure 5.16: Field ID for API usage
Source Configuration Options

Click on the CONFIGURE SOURCE menu option of a source view to get access to a panel (see Figure 6.1) where you can alter the way BigML processes your sources. The following subsections cover the available options. Note: most of these options are only available for CSV files, not for other formats.

![Figure 6.1: Source configuration panel](image)

### 6.1 Locale

The locale\(^1\) allows you to define the specific language preferences you want BigML to use to process your source. This helps to ensure that some characters in your data are interpreted in the correct way. For example, different countries use different symbols for decimal marks.

\(^1\)https://en.wikipedia.org/wiki/Locale
BigML tries to infer the locale from your browser. BigML also makes the locales listed in Table 6.1 available.

<table>
<thead>
<tr>
<th>Language</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arabic</td>
<td>United Arab Emirates</td>
</tr>
<tr>
<td>Chinese</td>
<td>China</td>
</tr>
<tr>
<td>Dutch</td>
<td>Netherlands</td>
</tr>
<tr>
<td>English</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>English</td>
<td>United States</td>
</tr>
<tr>
<td>French</td>
<td>France</td>
</tr>
<tr>
<td>German</td>
<td>Germany</td>
</tr>
<tr>
<td>Greek</td>
<td>Greece</td>
</tr>
<tr>
<td>Hindi</td>
<td>India</td>
</tr>
<tr>
<td>Italian</td>
<td>Italy</td>
</tr>
<tr>
<td>Japanese</td>
<td>Japan</td>
</tr>
<tr>
<td>Korean</td>
<td>South Korea</td>
</tr>
<tr>
<td>Portuguese</td>
<td>Brazil</td>
</tr>
<tr>
<td>Russian</td>
<td>Russia</td>
</tr>
<tr>
<td>Spanish</td>
<td>Spain</td>
</tr>
</tbody>
</table>

Table 6.1: Default locales accepted by BigML

If your locale does not show on the Locale selector, and BigML does not process your data correctly, please let the Support Team at BigML\(^2\) know.

6.2 Single Field or Multiple Fields

The Single Field or Multiple Fields switch allows you to tell BigML if your source is composed of only one field of type items.

6.2.1 Auto-Detection of Single, Item-Type Fields

Sources containing a field of type items may be submitted without surrounding quotes, in which case the input will appear to have a varying number of columns in each row. Figure 6.2 shows an excerpt of a single-field source\(^3\). BigML will attempt to detect this case, rather than assume a “square” CSV format with a large number of bad rows. (See Figure 6.3). The criteria are as follows:

- The proportion of rows, whose column counts differ from the most frequent count, is greater than 0.25.
- There are no missing values as items.
- There are no items greater in length than 64 characters.

\(^2\)support@bigml.com
\(^3\)http://www.salesmarafii.com/code/market-basket-analysis-with-r/
When a single-column source is detected, its separator is set to the empty string (""). There is no separator when there are not at least two columns to separate. You can also indicate that a source consists of a single column by setting the separator to the empty string (""). Conversely, erroneous single-column auto-detections can be overridden via an update of the source by setting an items separator that is not the empty string.

### 6.3 Separator

The separator is the symbol that is used to separate each field within a CSV file. The default symbol is a comma (`,`) but you can choose one of the following ones or even input your own separator.

- semicolon (`;`)
- tab (`\t`)
6.4 Quotes

You can select the symbol that will be used to quote complete fields. This is mandatory when the field includes the character used as separator or break lines. The two options are single quote (') or double quote (").

6.5 Missing Tokens

You can specify a list of tokens that will be considered equivalent to a missing value. By default, BigML recognizes the following ones:

- ""
- _
- ?
- NA
- NaN
- NIL
- NULL
- N/A
- na
- null
- nil
- n/a
- #REF!
- #VALUE!
- #NULL!
- #NUM!
- #DIV/0
- #NAME?
- #N/A

You can alter the list at your own convenience using the corresponding input.

6.6 Header

You can instruct BigML to parse the first line of your CSV file as a header (i.e., First row is header information) or not (i.e., Don’t use the first row as header), or rely on BigML to auto-detect the presence of a header row (i.e., Smart header selection).

6.7 Expand Date-Time Fields

The Expand date-time fields toggles expansion of date-time fields into their numeric components. (See Section 5.3.)
6.8 Text Analysis

The TEXT ANALYSIS switch allows you to enable or disable analysis of text fields. The configuration options in this section are global for all the fields of your source, but you can also configure these options directly on individual text fields by overwriting the global configurations on a field-by-field basis. (See figure Figure 6.4.)

![Figure 6.4: Global and text fields configuration](image)

The options configured at the source level will take effect when you create the dataset. You can see the text analysis options configured for a given dataset if you display the DETAILS in the INFO panel from the dataset view (see Figure 6.5). Since a dataset can have many text fields with different languages, you can find the information about which languages have been detected in the tooltip when you mouse...
6.8.1 Language

BigML attempts to do basic language detection of each text field. You can choose any of the following languages at a global level or individual field level: Arabic, Catalan, Chinese, Czech, Danish, Dutch, English, Farsi/Persian, Finish, French, German, Hungarian, Italian, Japanese, Korean, Polish, Portuguese, Turkish, Romanian, Russian, Spanish, and Swedish.
6.8.2 Tokenize

Tokenization strategy allows splitting the text into several unique values. You can choose one of the following methods (default is “All”):

- **Tokens only**: individual words are used as terms. For example, “ML for all” becomes ["ML", "for", “all”].

- **Full terms only**: the entire field is treated as a single term as long as it is shorter than 256 characters. In this case “ML for all” stays [“ML for all”]

- **All**: both full terms and tokenized terms are used. In this case [“ML for all”] becomes [“ML”, “for”, “all”, “ML for all”].

![Tokenize configuration options](Figure 6.7: Tokenize configuration options)

6.8.3 Stop Words Removal

The **Stop words removal** selector allows you to remove the use of usually uninformative stop words as part of the text analysis. Some examples of stop words are: a, the, is, at, on, which, etc. Obviously, these change according to the language chosen to process each text field. This is the reason why BigML offers three options:

- **Yes (detected language)**: this option removes the stop words only for the detected language. If you have several languages mixed within the same field, the stop words of the non-detected languages will appear in your models. This is the option selected by default.

- **Yes (all languages)**: this option removes the stop words for all languages. Although you have several languages mixed within the same field, you will not find any stop words in your models. The downside is that some stop words for some languages may be valid words for other languages.

- **No**: this option will avoid the stop words removal. Therefore, the stop words will be included in your text analysis.

---

Next to the **Stop words removal** selector you will find another selector that allows you to choose the aggressiveness of stopword removal where each level is a superset of words in the previous ones: **Light**, **Normal**, and **Aggressive**. By default, BigML performs **Normal** stop words removal.

![Stop words configuration options](https://en.wikipedia.org/wiki/N-gram)

### 6.8.4 Max. N-Grams

The **Max. n-grams** selector allows you to choose the maximum n-gram size to consider for your text analysis. An n-gram is a frequent sequence of n terms found in the text. For example, “market” is a unigram (n-gram of size one), “prime minister” is a bigram (n-gram of size two), “Happy New Year” is a trigram (n-gram of size three), and so on. If you choose to keep stop words, they will be considered for the n-grams. You can select from unigrams up to five-grams.

---

6.8.5 Stemming

BigML can differentiate all possible words or apply stemming\(^6\), so words with the same root are considered one single value. For example, if stemming is enabled, the words great, greatly and greatness would be considered the same value instead of three different values. This option is enabled by default.

---

\(^6\)https://en.wikipedia.org/wiki/Stemming
6.8.6 Case Sensitivity

Specify whether you want BigML to differentiate words if they contain upper or lower cases. If you click the case sensitivity option, terms with lower and upper cases will be differentiated, e.g., “House” and “house” will be considered two different terms. This option is inactive by default.
6.8.7 Filter Terms

You can select to exclude certain terms from your text analysis. BigML provides the following options:

- **Non-dictionary words**: this option excludes terms that are unusual in the provided language. For this filter, BigML uses its own custom dictionaries that are composed of different sources such as online word lists, parses of Wikipedia, movie scripts, etc. These sources may change depending on the language. The words in our dictionaries might contain terms like slang, abbreviations, proper names, etc. depending on whether or not these words are common enough to be found in our internet sources.

- **Non-language characters**: this option excludes terms containing uncommon characters for words in the provided language. For example, if the language is Russian, all terms containing non-Cyrillic characters will be filtered out. Numeric digits will be considered non-language characters regardless of language.

- **HTML keywords**: this option excludes JavaScript/HTML keywords commonly seen in HTML documents.

- **Numeric digits**: this option excludes any term that contains a numeric digit in [0-9].

- **Single tokens**: this option excludes terms that contain only a single token, i.e., unigrams. Only bigrams, trigrams, four-grams, five-grams and/or full terms will be considered (at least one of these options needs to be selected, otherwise the single token filter will be disabled).

- **Specific terms**: this is a free text option where you can write any term or group of terms to be excluded from your text analysis.
Figure 6.12: Filter terms
6.9 Image Analysis

The IMAGE ANALYSIS panel allows users to enable or disable extracted features of images, and allows them to configure different sets of the features.

The first control is the DISABLED/ENABLED switch. If disabled, there won’t be any image features generated.

If enabled, users can configure to have any combination of the following five sets of image features:

- **Dimensions**: This gives four values, corresponding to the raw image file size, pixel width, pixel height and aspect ratio. 4 numeric fields.

- **Average pixels**: This gives the red, blue, and green pixel values for several extremely low resolution versions of the image (1x1, 3x3 and 4x4). This is fast to calculate and captures the high-level spatial and color information, but all detail is lost. 78 numeric fields.

- **Level histogram**: This gives the color information in each channel divided into 16 equally spaced histogram bins. Each color histogram is normalized so all values are between 0 and 1. While this gives very detailed color intensity information, all spatial information is lost. 48 numeric fields.

- **Histogram of gradients**: Computes a histogram of oriented gradients for the entire image, and for all subimages on a 3x3 and 4x4 grid. The histograms are normalized within each subimage, so all values are between 0 and 1. This histogram generally captures useful spatial and detail information, but precise color information is lost. Generally, this extractor is good at classifying different shapes, or images where the orientation of the edges is a defining characteristic. 234 numeric fields.

- **Wavelet subbands**: Performs an $n$ level Haar wavelet decomposition on the image, where $n$ is a parameter. This parameter determines the number of recursive compositions that the featurizer will undertake, and so determines the number of output features. After decomposition, the pixels in each subband are aggregated using mean and standard deviation for both the full images and
a 2x2 grid. Since each subband contains all image detail at a certain resolution in one of three directions, this feature type contains both spatial and frequency domain information about the nature of the detail in the image, but the directionality of the detail is only coarsely captured (contrast histogram of gradients). Typically useful for problems where texture is a defining characteristic of the image, or where there is obvious periodicity. 160 numeric fields.

Users can also configure to have one of the five pre-trained CNNs (Convolutional Neural Networks):

- **MobileNet**: 1024 numeric fields.
- **MobileNetV2**: 1280 numeric fields.
- **ResNet-18**: 512 numeric fields.
- **ResNet-50**: 2048 numeric fields.
- **Xception**: 2048 numeric fields.

**Note**: ResNet-50 and Xception are only available to customers of virtual private clouds and private deployments

Each option uses the top layer before the softmax output of an ImageNet pre-trained CNN as the input features. These features generally capture high-level features useful for real-world object classification (the presence of eyes, wheels, or striped fur, for example). While these features are easily the best for natural image classification, poor capture conditions and artificial domains (handwriting, images of documents, low resolution security video, etc.) can make these features unsuitable.

### 6.10 Items Separator

You can select the specific separator that will be used by items fields. By default, BigML tries to auto-detect it. If the BigML selection is incorrect, you can select one of the predefined defaults or you can input another one (see Figure 6.14).

![Figure 6.14: Items separator selection](image)

A source can have multiple fields of type items and each one can have a different separator. Once you open a source configuration panel for those fields that are of type items, a configuration icon will allow you to select the specific separator for that field. (See Figure 6.15.)
6.11 Updating Field Types

The type of each field can be updated individually using the Configure source panel and then selecting the new type for each field using the selector provided for each field. (See Figure 6.16.) Text, items and date-time fields also offer additional specific configurations.

6.11.1 Date-Time Formats Configuration

In the case of date-time fields, it might happen that BigML is not able to determine the right format. In that case, you can select the specific format of your fields by clicking in the configuration icon shown in Figure 6.17. You can choose any of the pre-defined formats included in Table 5.1 among the selector options.
If you do not find the format of your date-time field in the pre-defined options you can also configure your own format using the option “Other”. (See Figure 6.18.)

This custom option allows you to input any string using the Java DateTimeFormatter specification\(^7\) for date-time patterns. For example, for month and year you need to use the upper-case letters MM and YY, while for day you need to use the lower-case letters dd. See an example of a custom date format in Figure 6.18 where the date is written as MM/dd/YY, i.e., 100314 meaning 3rd of October 2014.

\(^7\)https://docs.oracle.com/javase/10/docs/api/java/time/format/DateTimeFormatter.html
Figure 6.19: Custom date format example
Local Sources

The easiest way to create a new source in BigML is to drag a file that follows one of the formats described in Section 1.2 and drop it on top of the BigML Dashboard.

BigML allows you to upload up to ten files in parallel. For each file, BigML will display a progress bar that indicates how far along the uploading process is. You can navigate to other parts of the BigML Dashboard or initiate other tasks while you upload new sources to BigML. You can also stop every individual upload by clicking on the X on the right side of each progress bar. (See Figure 7.1.)

You can also use the upload source button (see Figure 7.2) that is available in the source list view to upload a new source. This will open a Open File Dialog Box that will allow you to navigate through your local file system.
Remote Sources

Sources can also be created using remote data as opposed to the files on local storage. You can connect to your databases and create Sources directly from them (Section 8.8). You can use your cloud storages (Section 8.7). You can also create Sources by using URLs that point to external source files. BigML will use the URL to download the data and create a local copy.

In the source list view, you will find the remote source button (see Figure 8.1) that will open a new modal (see Figure 8.2) window, where you can specify the URL and also give a name to the new remote source. URLs must follow one of the accepted protocols described in Section 8.1.

Figure 8.2: Modal window to create a remote source using a URL
8.1 Accepted Protocols

The list of accepted protocols to create remote sources is displayed on Table 8.1. The following subsections detail each of the stores BigML can communicate with.

<table>
<thead>
<tr>
<th>Schema</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>asv://</td>
<td>Same as azure://</td>
</tr>
<tr>
<td>asvs://</td>
<td>Same as azures://</td>
</tr>
<tr>
<td>azure://</td>
<td>Microsoft Azure storage</td>
</tr>
<tr>
<td>azures://</td>
<td>Same as azure:// but using SSL</td>
</tr>
<tr>
<td>drobox://</td>
<td>Drobox-stored files</td>
</tr>
<tr>
<td>gcs://</td>
<td>Google Cloud stores</td>
</tr>
<tr>
<td>gdrive://</td>
<td>Google Drive files</td>
</tr>
<tr>
<td>hdfs://</td>
<td>The distributed storage used by Hadoop applications</td>
</tr>
<tr>
<td>http://</td>
<td>Regular HTTP-accessible files</td>
</tr>
<tr>
<td>https://</td>
<td>HTTP secure-accessible files</td>
</tr>
<tr>
<td>odata://</td>
<td>Open Data Protocol(^1) that consumes REST APIs</td>
</tr>
<tr>
<td>odatas://</td>
<td>Same as odata:// but using SSL</td>
</tr>
<tr>
<td>s3://</td>
<td>Simple Storage Service(^2) (S3), the file storage provided by Amazon Web Services (AWS)</td>
</tr>
</tbody>
</table>

Table 8.1: Protocols recognized by BigML

8.2 HTTP(S) Stores

Regular HTTP and HTTPS links can be used as the URI of remote sources:

http://bigml.com/test/data.csv
https://bigml.com/test/data.csv

Figure 8.3: Example of HTTP and HTTPS remote sources

By default, BigML does not perform any certificate validation for HTTPS links, but you can ask for it using the query string parameter `validate`, as in this example:

https://bigml.com/test/data.csv?validate=true

Figure 8.4: Example of an HTTPS remote source requesting validation

8.3 Azure Stores

BigML can retrieve sources directly from Azure as block or page blobs. The URLs take the following forms:
The `azures` variant asks for HTTPS, instead of HTTP, for the end point protocol. You can also use `asv` and `asvs` instead of `azure` and `azures`, respectively.

The `AccountKey` parameter is unnecessary for public blobs; in addition, one can add the following parameters:

- `DefaultEndpointsProtocol` either `http` or `https` overrides the one implied by the URI scheme.
- `BlobEndPoint` for blobs that use their own domain names instead of Azure’s default `blob.core.windows.net`.
- `SharedAccessSignature` for shared containers, in which case the account credentials will be ignored.

Finally, if using the default end points, the URL can be specified as the blob’s REST URL:

```
http://<account name>.blob.core.windows.net/<container>/<blob>?AccountKey=...
```

Having the same parameters as above except that the account name is now part of the URL. HTTPS URLs of the same form are also recognized as Azure blobs.

### 8.4 HDFS

BigML also allows you to access to files stored using HDFS\(^4\), the primary distributed storage used by Hadoop applications. HDFS remote sources follow this template:

```
hdfs://host:port/path/hdfs/file.csv
```

Remote sources can specify an OData URI as its source, accessible either by HTTP or HTTPS, by using the `odata` or `odatas` scheme. For instance, the URI in Figure 8.8 will request BigML to access the table `Customers` in the OData root `http://services.odata.org/Northwind/Northwind.svc`.

You can use any OData URL parameter to construct the result set (BigML will just use the given URL as is, specifying to the OData service that it wants its result in JSON format), as long as the answer to the query contains a list of results (i.e., an entity set, or OData “table” or “view”). To select only the first 100 rows of the above source, and only the City and PostalColumns you could write:

```
odata://services.odata.org/Northwind/Northwind.svc/Customers?$top=100&$select=City,PostalColumns
```

BigML also accepts the abbreviations od:// and ods:// for odata:// and odatas://, respectively. Only columns with atomic (number, string, boolean) values are imported by BigML. For any inner field in a composite value to be part of the source, just construct the appropriate query with the URL parameters. For more information about OData URIs, see OData URI conventions.

As a special case, BigML recognizes Azure Marketplace HTTPS URLs with hostname api.datamarket.azure.com as OData stores. Create a remote source using the URL displayed in Figure 8.10, and it will be treated as if it were the canonical form shown in Figure 8.11.

```
```

As always, you can also use odata or https for the schema.

---

5http://www.odata.org/documentation/odata-version-2-0/uri-conventions/
8.6 S3 Stores

Source files stored in Amazon Simple Storage Storage (S3) can be specified using URLs of the form shown in Figure 8.13.

\[\text{s3://bucket/path/identifier?access-key=key0&secret-key=key1}\]

Figure 8.13: Template of an S3 Remote Source

The two keys \textit{access-key} and \textit{secret-key} are optional. BigML Private Deployments will use default values read from its configuration, either in the s3 section of the configuration file or as the CLI parameters \texttt{--s3-access-key} and \texttt{--s3-secret-key}. Keys present in a URL always override those defaults.

8.7 Cloud Storages

You can create BigML Sources by downloading data from your cloud storages. Because of the popularity of cloud storages, BigML gives users the ability to configure their cloud storages on the Dashboard.

8.7.1 Configuring Cloud Storages

BigML allows you to configure the following cloud storage providers at \url{https://bigml.com/account/cloudstorages} (see Figure 8.14):

- Google Cloud Storage
- Google Drive
- Dropbox
- Microsoft Azure Marketplace

If you enable cloud storage providers, you will have a new menu option in the listing source view where you can use a widget to navigate through those storages and locate your source. (See Figure 8.15.)
To use any of those cloud storage providers, you need to first grant BigML access to it or provide your credentials. You can revoke the access or disable the new menu options at any time.

### 8.7.2 Dropbox

Given the OAuth token for a Dropbox file, request its download as a source via the Dropbox scheme, providing the token in the query string, without host:

```
dropbox:/path/to/file.csv?token=adwfdfda_weke23423_fheh324sxke33
```

For instance, for the file `iris.csv` at the root of your Dropbox you could use:

```
dropbox:/iris.csv?token=adwfdfda_weke23423_fheh324sxke33
```

For the same file inside a `csv` folder the correct URI would be:

```
dropbox:/csv/iris.csv?token=adwfdfda_weke23423_fheh324sxke33
```

### 8.7.3 Google Cloud Storage

Remote sources can use the `gcs` schema to specify any file stored in a Google Cloud Storage bucket. For publicly shared files, no other parameter is needed, e.g., if `iris.csv` is in the folder `customdata` of the `bigml` bucket use:

```
gcs://bigml/customdata/iris.csv
```

If the file is protected and you have an OAuth2 access token which has not yet expired, specify it via the token query string parameter:

```
gcs://bigml/customdata/iris.csv?token=adwfdfda_weke23423_fheh324sxke33
```
gcs://bigml/test.csv?token=ya29.ygCrfy3xq18g5eIPM1IPUqqa8v0xOOk1XfDI

Figure 8.20: Example of a Google Cloud Storage URL using OAuth2

In addition, if you also have a refresh token, and your client identifier and application secret, they can be specified together with the token using the additional query string parameters refresh-token, client-id and app-secret, respectively, and BigML will take care of refreshing the possibly expired token as needed.

### 8.7.4 Google Drive

Remote sources using the `gdrive` protocol refer to files stored in **Google Drive** (GDrive). The full URI does not use a host, so it usually starts with `gdrive://`, and its only path component refers to the required file’s file-id, as provided by the Google Drive service.

GDrive files are granted access via OAuth2, so you also need a client ID, app secret, a token, and refresh token to access the file. Generally, a `gdrive` URI looks like:

```
gdrive://<file-id>?token=<..>&refresh-token=<..>&app-secret=<..>&client-id=<...>
```

**Figure 8.21: Template of a Google Drive URL**

For example:

```
gdrive:///0BxGbAMhJezOScTFBUVFPFPMy1sTzE?token=ya29.AQHpyxUssLrU70y4sEtUjcyVnJPJ0uZ2Sc_ze3_08_14miBDJPlfxmqyk0C0v9H01savjV9Gt7eqSg-6krefresh-token=1/x6zd8Wjy__yk437S7AxZ5Yy7ZVXj0SVEBUSE-Xb00e6r&client-id=007234789065317-07jijg5o912o1v322h1k2rmif7e3s6.apps.googleusercontent.com&app-secret=AvbIGURJindyosjt2342SHVT4h
```

**Figure 8.22: Example of a Google Drive URL**

### 8.8 External Data Stores

You can create BigML Sources directly from external data stores, which are databases or search engines. For databases, BigML supports PostgreSQL, MySQL and SQL Server. The support of Spark SQL will be added in the near future. BigML also integrates with the Elasticsearch engine so that you can directly create Sources from it.

In order to create Sources, you will need establish connections to external data stores by creating external connectors.

In the BigML Dashboard, under the Sources tab, you can find a database icon with a dropdown for external data stores as shown below:
After choosing your desired data store from the dropdown list, you can then either select from existing external connectors or create a new external connector. You can also switch to a different data store here.

**8.8.1 Creating a New External Connector for Data Stores**

To create a new external connector for a data store, you will need to provide all the necessary information. This can vary depending on the different data stores.

For databases such as PostgreSQL, MySQL and SQL Server, you will need to provide the Host name, the Port number, the authentication information which are the Username and Password, and the name of the Database you want to import. You also can specify to use SSL or Verify certificates.
For Elasticsearch, you will need to provide the Host name and the authentication information as well. But instead of the name of the Database, optionally you can provide the Index or Alias for the search, as shown here:

**Figure 8.26: Form to create a new external connector for Elasticsearch**

### 8.8.2 Editing an External Connector for Data Stores

You can edit an existing external connector by clicking on the pencil icon next to the connector you’ve selected.
You then can modify the parameters of the external connector:

![Edit connector for a database](image)

Figure 8.28: Edit an external connector for a database

Here is an example to edit the parameters of an external connector for Elasticsearch:
8.8.3 Creating a Source From a Data Store

After you select an existing external connector to the desired data store or the newly created external connector from the dropdown list, you will see a Query box and a Table list:

Here you have two ways to import your data.
8.8.3.1 Creating Sources by Selecting Tables

The Table list contains all tables and views (where applicable) from your data store. By clicking on the checkboxes, you can select one or more tables and views. Then you import them into your BigML account as BigML Sources by clicking on the import button. Each table will be imported into a separate Source.

If you would like first to take a look at the data from a given table before importing, you can click on the table in the Table list for a preview. In the preview, you can see the table columns and some sample data. See this for an example of database table preview:
You can also create a Source by constructing a SQL query. This is useful because sometimes the database table import is too simplistic. By using a SQL Select statement, you can select the exact data you want, even from multiple tables and views.

If you only wish to import a subset of columns from a table, the query can be as simple as

```
select sepal_width, petal_width, species from iris2
```

When you preview a whole table, you can see that the select statement in the Query box (See Figure 8.32.):

```
select * from iris2
```

After writing the query in the Query box, you can click on the Search button on the right to execute it. This can verify the query is valid in your data store. It also gives you a preview by showing the initial results, which allows you to confirm your intentions before creating the BigML Source.

You can actually take advantage of your data store’s full query language. Below is a more advanced example, which shows a select statement with both a join and group-by clause. In the database, there is one table with school district information, and another containing individual teacher statistics. By using the select statement, we are creating a BigML Source with information about school districts that include the average teach salary in each district:

```
select d.graduation_rate, d.students district_size, 
    avg(t.salary) average_teacher_salary 
from district d, teacher t 
where t.district_id = d.id 
group by d.id, d.students, d.graduate_rate
```

Figure 8.33: Importing by using an advanced query

### 8.8.4 Creating a Source From a Data Store Via API

Creating Sources from external data sources is fully supported in the BigML API. You can use BigML API to programmatically create, retrieve, update, delete and list external connectors, and then use them to import.
Just like on the Dashboard, you can import data with either a table or a custom query. Here is an example using curl that imports a “Sales” table as a BigML Source.

```bash
curl "https://bigml.io/source?$BIGML_AUTH" \
  -X POST \
  -H 'content-type: application/json' \
  -d '{"external_data": {  "source": "sqlserver",  "connection": {    "host": "db.bigbox.com",    "port": 1433,    "database": "biztel",    "user": "autosource",    "password": "********"  },  "tables": "Sales"}}'
```

With BigML API, you actually have a few options to control the imported data without using a custom query. You can specify which fields to include or which to exclude, as well as limiting the number of records to import. You can also specify an offset along with an ordering to put that offset in context.

For Elasticsearch, creating a BigML Source using API is similar, as shown by the following example:

```bash
curl "https://bigml.io/source?$BIGML_AUTH" \
  -X POST \
  -H 'content-type: application/json' \
  -d '{"external_data": {  "source": "elasticsearch",  "connection": {    "host": "localhost",    "port": 9200,    "user": "username",    "password": "********"  },  "tables": "kibana_sample_data_logs"}}'
```

For more information on importing data directly through the BigML API, please refer to the documentation².

²https://bigml.com/api/externalconnectors
Inline Sources

The BigML Dashboard also has a simple editor that allows you to create “inline” sources. You can open it using the button shown on Figure 9.1.

![Inline Source Editor](image)

Figure 9.1: Button to open the inline source editor

You can see what the editor looks like on Figure 9.2. You can just type your data or copy and paste it. Inline sources are useful for basic experimentation and to learn and practice Machine Learning with BigML.
Figure 9.2: Editor of inline sources
Size Limits

BigML does not impose any limits on the number of sources you can upload to a single account or on the number of sources you can assign to a specific project. Each source can store an arbitrarily-large number of instances and also manage a relatively big number of fields. For example, the BigML multi-tenant version can process datasets with hundreds of millions of rows and dozens of thousands of fields.

The BigML multi-tenant version does impose some limits on the total size of files, depending on the way you bring your data to BigML:

**Local sources**: files uploaded directly including through the browser, drag and drop, or through the API are limited to **64 GB** in size.

**Remote sources**: files uploaded using any of the accepted protocols defined in Section 8.1 are also limited up to **64 GB**; however using Amazon Simple Storage Service (S3), the limit is **5 TB**.

**Inline sources**: sources created using the online editor are limited to **16 MB**.

If yours is a case where the machine learning-ready data exceeds these size limits, please consider a BigML Private Deployment that can raise those limitations and be tailored to manage bigger datasets.
Descriptive Information

Each source has an associated **name**, **description**, **category**, and **tags**. A brief description follows for each concept. In Figure 11.2, you can see the options that the **More info** panel gives to edit them.

### 11.1 Source Name

Each source has an associated **name** that is displayed on the list and also on the top bar of a source view. Source names are indexed to be used in searches.

When you create a source, the default name is that of the file used to create it. Edit it using the **More info** panel on the right corner of the source view. (See Figure 11.2.)

The name of a source cannot be longer than **256** characters. There is no restriction on the characters that can be used in a source name. More than one source can have the same name even within the same project. They will always have different identifiers.

### 11.2 Description

Each source also has a **description** that it is very useful for documenting your Machine Learning projects. Descriptions can be written using plain text and also **markdown**.1 BigML provides a simple markdown editor that accepts a subset of markdown syntax. (See Figure 11.1.)

---

1[https://en.wikipedia.org/wiki/Markdown](https://en.wikipedia.org/wiki/Markdown)
Descriptions cannot be longer than 8192 characters and can use almost any character.

### 11.3 Category

Each source is associated with a category. Categories are useful to classify sources according to the domain from which your data is taken. (See Figure 11.2.) This is useful when you use BigML to solve problems across industries or multiple customers.

A source category must be one of the categories listed on table Table 11.1.
### Table 11.1: Categories used to classify sources by BigML

<table>
<thead>
<tr>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace and Defense</td>
</tr>
<tr>
<td>Automotive, Engineering and Manufacturing</td>
</tr>
<tr>
<td>Banking and Finance</td>
</tr>
<tr>
<td>Chemical and Pharmaceutical</td>
</tr>
<tr>
<td>Consumer and Retail</td>
</tr>
<tr>
<td>Demographics and Surveys</td>
</tr>
<tr>
<td>Energy, Oil and Gas</td>
</tr>
<tr>
<td>Fraud and Crime</td>
</tr>
<tr>
<td>Healthcare</td>
</tr>
<tr>
<td>Higher Education and Scientific Research</td>
</tr>
<tr>
<td>Human Resources and Psychology</td>
</tr>
<tr>
<td>Insurance</td>
</tr>
<tr>
<td>Law and Order</td>
</tr>
<tr>
<td>Media, Marketing and Advertising</td>
</tr>
<tr>
<td>Miscellaneous</td>
</tr>
<tr>
<td>Physical, Earth and Life Sciences</td>
</tr>
<tr>
<td>Professional Services</td>
</tr>
<tr>
<td>Public Sector and Nonprofit</td>
</tr>
<tr>
<td>Sports and Games</td>
</tr>
<tr>
<td>Technology and Communications</td>
</tr>
<tr>
<td>Transportation and Logistics</td>
</tr>
<tr>
<td>Travel and Leisure</td>
</tr>
<tr>
<td>Uncategorized</td>
</tr>
<tr>
<td>Utilities</td>
</tr>
</tbody>
</table>

### 11.4 Tags

A source can also have a number of **tags** associated with it. This helps to retrieve the source via the BigML API and provides sources with some extra information. Each tag is limited to a maximum of 128 characters. Each source can have up to 32 different tags. (See Figure 11.2.)
11.5 Counters

For each source, BigML also stores a number of counters to track the number of other resources that have been created using the corresponding source as starting point. In the source view, you can see a menu option that displays these counters which also allow you to quickly jump to all the resources of one type that have been created with this source. (See Figure 11.3.)

11.6 Field Names, Labels and Descriptions

In addition to its name, each field of a source can also be furnished with extra information such as a label and a description. This information is displayed when you mouse over fields. It can be very useful to recognize what each field means on your model since labels and descriptions are inherited when you create other resources.

When you mouse over each field in a source view, you will see a pencil. Clicking on it, opens a dialog box such as the one displayed on Figure 11.4 that will allow you to update the name, label, and description of that field.
Figure 11.4: Updating a field name, label, and description
Source Privacy

BigML allows you to share sources via secret links as it does with other types of resources; the privacy options for a source can be configured in the MORE INFO menu option, shown in Figure 12.1. There are two levels of privacy for BigML sources:

- **Private**: only accessible by authorized users (the owner and those who have been granted access by him or her).
- **Shared**: accessible by any user with whom the owner shares a secret link. Here users can also decide whether to make the source clonable.

![Figure 12.1: Source privacy options](image)

**Figure 12.1: Source privacy options**
Moving Sources

When you create a source, it will be assigned to the project indicated on the project selector bar. (See Figure 13.1.)

When the project selector bar shows All and you create a new source, it will not be assigned to any project.

Sources can only be assigned to a single project. However, you can move sources between projects. The menu option to do this can be found in two places:

1. In the source view, within the 1-click actions for each source. (See Figure 13.2.)

2. Within the 1-click actions of a source in the source list view. (See Figure 13.3.)
Figure 13.3: Menu option to move sources from the source list list view
Deleting Sources

You can delete your sources from the source view, using the DELETE SOURCE menu option in 1-click action menu or using the pop up menu in the source list view.

![Delete a source menu option](image)

A modal window (see Figure 14.2) will be displayed asking you for confirmation. Once a source is deleted, it is permanently deleted, and there is no way you (or even the IT folks at BigML) can retrieve it.

![Delete data source?](image)
You can also delete a source from the **source list view**. On the 1-click pop up menu that is displayed for each source, you will find an option for deleting. (See Figure 14.3.)

![Delete a source pop up menu option](image)

**Figure 14.3: Delete a source pop up menu option**

**Note:** if you try to delete a source while it is being used to create a dataset you will see an alert that the source cannot be deleted now. (See Figure 14.4.)

![Alert displayed when trying to delete a source being used to create a dataset](image)

**Figure 14.4: Alert displayed when trying to delete a source being used to create a dataset**
Takeaways

This chapter explains sources in detail. Here’s a list of key points:

• A source allows you to bring data to BigML.
• BigML recognizes a variety of formats, protocols, and storages to create new sources.
• A source stores an arbitrarily-large collection of instances describing an entity of interest you want to model.
• BigML works best with data in a tabular format where each row represents an instance of the entity you want to model, and each column represents a field describing all the instances.
• After you create your source in BigML, each field in your source is displayed as a row and each column as an instance. This is because for highly dimensional data the transposed layout provides better navigability (i.e., datasets with thousands of fields can be paginated better).
• A source helps BigML to know how to parse your data so that the instances and field types can be correctly processed.
• You can configure your source in multiple ways to ensure BigML parses every field right.
• You can create sources from local files, remote files, or using an inline editor.
• Uploading one non-archive file, or one archive file (tar or zip) containing only one file, will create a single source. Uploading an archive file (tar or zip) containing multiple files will create a composite source.
• BigML supports sources in different formats, such as Table (CSV or JSON), Image, or Table+Image.
• A source is open when it can be modified. When a source is used to create a dataset, it’s automatically closed.
• A source can be cloned. A cloned source is created as an open source.
• You can create sources using image files. BigML supports a wide range of image formats.
• An archive (tar or zip) file containing more than one images will create an image composite source, which can be used to create datasets for machine learning.
• If images are inside folders in the archive file (tar or zip), uploading the archive file will create image composite sources with an added label field, the values of the label being the respective innermost folder names.
• In the fields view, sources view and images view of an image composite source, you can view its fields, component sources, and images, respectively. You can also select component sources or images to perform certain operations, including adding labels to images in an open image composite source.
• When an image composite source is created, by default BigML extracts 234 features per image, representing its histogram of gradients. You can configure five sets of extracted image features
in an open image composite source. You can also select one pre-trained convolutional neural network (CNN).

- You can furnish your source with descriptive information (name, description, tags, and category) and also every individual field (name, label, and description).
- You can only assign a source to a specific project.
- You can permanently delete a source.
- Figure 15.1 graphically represents the workflows a BigML source enables. A BigML source can be created using local, remote, cloud-stored, or inline sources and can be used to create datasets.

Figure 15.1: Source workflow
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**Glossary**

**Association Discovery** an unsupervised Machine Learning task to find out relationships between values in high-dimensional datasets. It is commonly used for market basket analysis. 55

**Dashboard** The BigML web-based interface that helps you privately navigate, visualize, and interact with your modeling resources. ii, 2

**Dataset** the structured version of a BigML source. It is used as input to build your predictive models. For each field in your dataset a number of basic statistics (min, max, mean, etc.) are parsed and produced as output. ii, 4, 63

**Entity** the object or subject of interest in your modeling task. A dataset is a collection of instances of the entity of interest. 2, 4, 104

**Field** an attribute of each instance in your data. Also called "feature", "covariate", or "predictor". Each field is associated with a type (numeric, categorical, text, items, or date-time). 2, 104

**Instances** the data points that represent the entity you want to model, also known as observations or examples. They are usually the rows in your data with a value (potentially missing) for each field that describes the entity. 2, 104

**Project** an abstract resource that helps you group related BigML resources together. 3, 4, 100, 105

**Resource** any of the Machine Learning objects provided by BigML that can be used as a building block in the workflows needed to solve Machine Learning problems. 4, 99

**Source** the BigML resource that represents the data source to which you wish to apply Machine Learning. A data source stores an arbitrarily-large collection of instances. A BigML source helps you ensure that your data is parsed correctly. The BigML preferred format for data sources is tabular data in which each row is used to represent one of the instances, and each column is used to represent a field of each instance. ii, 2, 7, 104
References
