

ARFF – Attribute Relation File Format Updated Oct. 29, 2015

Information from <http://www.cs.waikato.ac.nz/ml/weka/arff.html>

An ARFF (Attribute-Relation File Format) file is an ASCII text file that describes a list of instances sharing a set of attributes.

Overview

ARFF files have two distinct sections. The first section is the **Header** information, which is followed the **Data** information.

The **Header** of the ARFF file contains the name of the relation, a list of the attributes (the columns in the data), and their types. An example header on the standard IRIS dataset looks like this:

```
% 1. Title: Iris Plants Database
%
% 2. Sources:
%   (a) Creator: R.A. Fisher
%   (b) Donor: Michael Marshall (MARSHALL%PLU@io.arc.nasa.gov)
%   (c) Date: July, 1988
%
@RELATION iris

@ATTRIBUTE sepallength NUMERIC
@ATTRIBUTE sepalwidth  NUMERIC
@ATTRIBUTE petallength NUMERIC
@ATTRIBUTE petalwidth  NUMERIC
@ATTRIBUTE class       {Iris-setosa,Iris-versicolor,Iris-virginica}
```

The **Data** of the ARFF file looks like the following:

```
@DATA
5.1,3.5,1.4,0.2,Iris-setosa
4.9,3.0,1.4,0.2,Iris-setosa
4.7,3.2,1.3,0.2,Iris-setosa
4.6,3.1,1.5,0.2,Iris-setosa
5.0,3.6,1.4,0.2,Iris-setosa
5.4,3.9,1.7,0.4,Iris-setosa
4.6,3.4,1.4,0.3,Iris-setosa
5.0,3.4,1.5,0.2,Iris-setosa
4.4,2.9,1.4,0.2,Iris-setosa
4.9,3.1,1.5,0.1,Iris-setosa
```

Lines that begin with a % are comments. The **@RELATION**, **@ATTRIBUTE** and **@DATA** declarations are case insensitive.

Examples

Several well-known machine learning datasets are distributed with Weka in the `$WEKAHOME/data` directory as ARFF files.

The ARFF Header Section

The ARFF Header section of the file contains the relation declaration and attribute declarations.

The @relation Declaration

The relation name is defined as the first line in the ARFF file. The format is:

```
@relation <relation-name>
```

where *<relation-name>* is a string. The string must be quoted if the name includes spaces.

The @attribute Declarations

Attribute declarations take the form of an ordered sequence of **@attribute** statements. Each attribute in the data set has its own **@attribute** statement which uniquely defines the name of that attribute and its data type. The order the attributes are declared indicates the column position in the data section of the file. For example, if an attribute is the third one declared then Weka expects that all that attributes values will be found in the third comma delimited column.

The format for the **@attribute** statement is:

```
@attribute <attribute-name> <datatype>
```

where the *<attribute-name>* must start with an alphabetic character. If spaces are to be included in the name then the entire name must be quoted.

The *<datatype>* can be any of the four types supported by Weka:

- *numeric*

- *integer* is treated as *numeric*
- *real* is treated as *numeric*
- `<nominal-specification>`
- *string*
- *date* [`<date-format>`]

where `<nominal-specification>` and `<date-format>` are defined below. The keywords **numeric**, **real**, **integer**, **string** and **date** are case insensitive.

Numeric attributes

Numeric attributes can be real or integer numbers.

Nominal attributes

Nominal values are defined by providing an `<nominal-specification>` listing the possible values: `{<nominal-name1>, <nominal-name2>, <nominal-name3>, ...}`

For example, the class value of the Iris dataset can be defined as follows:

```
@ATTRIBUTE class    {Iris-setosa,Iris-versicolor,Iris-virginica}
```

Values that contain spaces must be quoted.

String attributes

String attributes allow us to create attributes containing arbitrary textual values. This is very useful in text-mining applications, as we can create datasets with string attributes, then write Weka Filters to manipulate strings (like `StringToWordVectorFilter`). String attributes are declared as follows:

```
@ATTRIBUTE LCC    string
```

Date attributes

Date attribute declarations take the form:

```
@attribute <name> date [<date-format>]
```

where <name> is the name for the attribute and <*date-format*> is an optional string specifying how date values should be parsed and printed (this is the same format used by SimpleDateFormat). The default format string accepts the ISO-8601 combined date and time format: yyyy-MM-dd'T'HH:mm:ss. Check out the Javadoc of the [java.text.SimpleDateFormat](#) class for supported character patterns.

Dates must be specified in the data section as the corresponding string representations of the date/time (see example below).

The ARFF Data Section

The ARFF Data section of the file contains the data declaration line and the actual instance lines.

The @data Declaration

The **@data** declaration is a single line denoting the start of the data segment in the file. The format is:

```
@data
```

The instance data

Each instance is represented on a single line, with carriage returns denoting the end of the instance.

Attribute values for each instance can be delimited by commas or tabs. A comma/tab may be followed by zero or more spaces. Attribute values must appear in the order in which they were declared in the header section (i.e., the data corresponding to the *n*th **@attribute** declaration is always the *n*th field of the attribute).

A missing value is represented by a single question mark, as in:

```
@data
```

4.4,?,1.5,?,Iris-setosa

Values of string and nominal attributes are case sensitive, and any that contain space must be quoted, as follows:

```
@relation LCCvsLCSH
```

```
@attribute LCC string
```

```
@attribute LCSH string
```

```
@data
```

```
AG5, 'Encyclopedias and dictionaries.;Twentieth century.'
```

```
AS262, 'Science -- Soviet Union -- History.'
```

```
AE5, 'Encyclopedias and dictionaries.'
```

```
AS281, 'Astronomy, Assyro-Babylonian.;Moon -- Phases.'
```

```
AS281, 'Astronomy, Assyro-Babylonian.;Moon -- Tables.'
```

Dates must be specified in the data section using the string representation specified in the attribute declaration. For example:

```
@RELATION Timestamps
```

```
@ATTRIBUTE timestamp DATE "yyyy-MM-dd HH:mm:ss"
```

```
@DATA
```

```
"2001-04-03 12:12:12"
```

```
"2001-05-03 12:59:55"
```

Sparse ARFF files

Sparse ARFF files are very similar to ARFF files, but data with value 0 are not be explicitly represented.

Sparse ARFF files have the same header (i.e. **@relation** and **@attribute** tags) but the data section is different. Instead of representing each value in order, like this:

```
@data
```

```
0, X, 0, Y, "class A"
```

```
0, 0, W, 0, "class B"
```

the non-zero attributes are explicitly identified by attribute number and their value stated, like this:

```
@data
```

```
{1 X, 3 Y, 4 "class A"}
```

```
{2 W, 4 "class B"}
```

Each instance is surrounded by curly braces, and the format for each entry is: `<index> <space> <value>` where index is the attribute index (starting from 0).

Note that the omitted values in a sparse instance are 0, they are not "missing" values! If a value is unknown, you must explicitly represent it with a question mark (?).