

UNIVERSITAT POLITÈCNICA DE CATALUNYA

ADVANCED MACHINE LEARNING TECHNIQUES

CBR Project Report: User Manual

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1 System Description and Purpose

The purpose of the system *CBR Bet Assistant* is to provide an educated prediction of football game outcomes based on the performances of the relevant past matches as well as odds of various bet providers. In the current version only predicting one of the three outcomes is supported: home team wins (1), draw (X), away team wins (2).

The system implements a case-based reasoning methodology and supports all four stages of it. The case library is represented by the collection of past matches (cases) while a number of custom functions (similarity/fitness) are integrated into individual CBR phases and pre-tuned to achieve best performance.

This manual lays out system requirements (Section 2) and describes its main functions (Section 4). Details of obtaining project source code are explained in Section 5.

2 System Requirements

The application was developed in python 2.7, we have abstained from using python version 3 for compatibility and stability reasons. In addition, some non-core libraries have been employed in the project:

1. pandas (v0.13.1) to read the datasets in CSV format
2. NumPy (v1.9.0) to benefit from the high performance of numeric and logical operations
3. Flask (v0.9) in order to run a web interface for the program

In order to run the application on the local machine, these listed libraries need to be installed.

3 System Installation

CBR Bet Assistant has two modes of operation: Console Interface and Web Interface. While the console interface requires a local installation, a more user-friendly and installation-free web interface is provided as an unrestricted online service.

3.1 Console Interface

Installation Apart from installing the external libraries specified in Section 2 there are no additional dependencies that need to be accounted for in order to run *CBR Bet Assistant* locally. As the project is implemented in python, it does not need to be compiled to binaries. The mere requirement is to place the root

project folder `CBR_Bet_Assistant` to an arbitrary location and navigate to the `./cbr/core/` directory: this is the location from where all relevant functions of the CBR could be triggered.

Start-Up / Shut-Down When executed in the console mode the system is in a live state only when it is evaluating a particular case (that is predicting an outcome of a match). After the task is completed the system automatically terminates and will be awoken again when the next request is made.

3.2 Web Interface

Installation If desired the web interface can also be started on a local machine by running the `cbr/web/index.py` module. Meanwhile an unrestricted online service is provided under the link <http://cbrbetassistant.pythonanywhere.com/>. It uses a free offer of the PythonAnywhere.com platform and thus will remain operational for the foreseeable future.

Start-Up / Shut-Down Unlike in the console version of the interface, the web interface is an unterminated process. The system continuously listens for the web requests and executes them. There is no need for explicit start-up/termination of the application except for possible service interruptions of the PythonAnywhere hosting platform.

4 Using Main Functions of the System

The CBR system provides the following main functions: 1) reading a custom dataset, 2) implicit training/testing, and 3) evaluating a case.

4.1 Reading a new Dataset

CBR Bet Assistant has been configured to provide prediction for the future football matches of the First Spanish Football League (the respective data can be located under `CBR_Bet_Assistant/data/[Test|Train]/`). The system can also operate with different datasets of football matches. In order to do that the files in the mentioned directories need to be replaced with alternative CSV datasets. When the next evaluation starts the system will automatically read the CSV datasets and create a case library based on it.

4.2 Continuous Learning

The system does not require a distinct learning phase, as it fine-tunes the parameters in an online fashion. Decisions if to retain or not to retain a particular case (given a definite expert evaluation) as well as what weights to assign to different features undergo continuous evaluation.

4.3 Case Evaluation

4.3.1 Console Interface

There are two modes in which the evaluation phase of the CBR can be performed if used from the console:

1. Providing an overall prediction accuracy measurement for the test dataset. This is done by looping through all the entries in the test file and making a prediction for each of the matches.

```
cd $PROJECTLOCATION
export PYTHONPATH=$PYTHONPATH:.
python cbr/core/validation.py
```

2. Performing a prediction for a particular team fixture that a system user is interested in. It is possible to provide a list of the known odds in a form of key-value pairs. A full list of valid betting providers can be found in the appendix of the technical manual.

```
cd $PROJECTLOCATION
export PYTHONPATH=$PYTHONPATH:.
python cbr/core/main.py 'Real Madrid' Barcelona
[B365H=1.0 B365D=2.1 B365A=3.0 ...]
```

A sample output of this command would look as following:

```
Loading data ...
Data loaded
Start CBR ...
Input Match: Real Madrid vs Barcelona
Prediction Result: H
```

Internally, the system assigns different confidence values for each of the tree possible outcomes, $1/X/2$. However, only the outcome with the highest probability is reported.

4.3.2 Web Interface

Using the *CBR Bet Assistant* as an online service is significantly more user friendly. The interface can be accessed under the address **cbrbetassistant.pythonanywhere.com** as displayed in the Figure 1. A user needs to select teams participating in a match and the odds of the various betting providers, if available. Clicking the button “Predict” will render a notification area with a prediction as calculated by the *CBR Bet Assistant*.

Figure 1: Web Interface

5 Source Code

The source code is also available under the link <https://github.com/Jeronics/CBR-system>. It can be copied and developed further as per the needs of individuals. Pull requests can be made to the owners of repository if certain changes need to be integrated into the code base.

We have striven to maintain an informative `readme.md` file for the project web page as per GitHub project conventions in order to provide an global overview of the project structure and main entry points. Along with listing the main entities the front page of the project page lists the delivery deadlines, data sources, and currently known/solved issues.