Generic On-Line Symbol Recognizer

*A generic tool for designing on-line handwriting recognition system*

Demo software
*(Windows / Linux)*

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1 Contributors

This software is the result of works in the connexionnist team headed by Professor Patrick Gallinari at the LIP6 lab in Université paris 6 (Computer Science Lab of Paris 6 University).

A number of contributors have worked on either the recognition engine or the interface.

This demo software was written in December 2004 by Jean-Baptiste Goyeau and is updated by Thierry Artières.

The recognition engine is the result of works along the five last years by Haifeng Li, Sanparith Marukatat, Rudy Sicard, Thierry Artières and Patrick Gallinari.

Part of this work has been made under grants from French Telecom.

2 What does this Software?

This system performs isolated character and symbol recognition.

Its main features are its ability to learn new symbols, characters and gestures from very few training samples, and its ability to learn any kind of "simple" drawing.

This demo allows you:

• Creating a database of on-line symbols, characters, drawings.
• Learning a recognition engine from a database.
• Drawing a character and performing recognition using a recognition engine.

Of course you can save databases and recognition engines for further sessions with the software.

3 Zip File content
3.1 Launching the software

Under windows, double-click on the Recognizer.jar icon.

Under linux, you must use the following command in the directory of where Recognizer.jar is:

```
java -jar Recognizer.jar
```

3.2 The Files Directory

It is the directory where all models and databases are saved. These files are in our own format.

3.3 The DLL File: stroke.dll

It is the recognizer library. You cannot modify it.

4 Interface organization

When you run the application, the interface looks like that:
The interface is divided in two parts.

4.1 The visualization area

This area is where you can see the samples of the database and the recognition engine. It is divided into the database panel on the left and the model panel on the right.
4.2 The Recognizer’s result panel and the drawing area

The drawing area is on the left. It is the area where you can draw symbols samples in order to:
- Add samples to the database.
- Launch the recognizer to determine which symbol you draw.

The recognition results are displayed on the right.

5 Loading, saving and visualizing a database

A database is a collection of characters samples. You may create a database by drawing a number of samples, save your database, and load a previously saved database.

5.1 Loading a database

When you want to reuse a previously saved database, you have to load it.

All databases are stored in directory "files/db/" under the home directory of the software.

When you click on the button "LOAD" in the top of the database panel, a menu appears where you can choose a database to be loaded. The database is now loaded and you can see it in the database panel.

Be careful: When loading a database, you lose the current database unless you saved it.
5.2 Visualizing

You may visualize the content of your database anytime. There is a scrolling character list in the left part of the database panel. It includes the list of existing characters in the current database. The number of samples per character is indicated.
When you click on a character, the first sample for this character is drawn. Then you may visualize all samples for this character by clicking on the bottom of the database panel on buttons “<” (previous sample) and “>” (next sample).

The way characters are drawn as a function of time is essential, the recognizer relies on this. You may ask for redrawing a sample by clicking on the “Redraw” button.

5.3 Saving a database

If you want to reuse a database that you just created, you have to save it before closing.

Saving a database means saving all its samples. It does not mean saving the recognizer.
To save a database, you have to click on "SAVE" button on the top the database panel. After clicking, a window appears where you can enter the name of the database. The database is then saved in the directory "files/db/" under the root directory of the software.

5.4 Closing a database

The "CLOSE" button closes the current database. You can create or load another one.

5.5 Creating a database

You can create a new database by adding, one per one, samples of the characters you want to be learned and recognized.

You can draw a symbol in the recognizer and drawing section by dragging the mouse on the writing area. This drawing symbol can be added to the database by clicking on the “Add Sample” button or the “Add New Char” button.
In case the character you draw is already known by the system, click on the “Add Sample” button. A window appears where you can choose the character corresponding to your sample. A particular character in red ink is proposed, it is the recognized character for your input. You may validate this proposition or click on another character.
In case you draw a new character that is not already in the database, click on the “Add New Char” button. You are asked to enter the name of this new char. It will appear as a new character in the characters list of the database panel.
6 The Recognizer

The recognizer determines which symbol in its database best matches a sample drawn in the drawing area.

The recognizer knows a close set of symbols, those that have been learned from a database or directly loaded from a previous session.

The recognizer consists in models of each symbol in the database. There are actually a few models for each symbol to account for various writing styles and allograph.

6.1 The Model panel

The Model panel on the upper right is very close to the database panel. It includes similar “LOAD”, “SAVE”, “CLOSE” buttons. You may visualize the models for a particular
character in the same way you visualize samples of a character in the database panel. There a few differences however.

### 6.1.1 Model visualization

The model visualization allows you to see the models for a particular character. The number of models for a character is indicated in the character list of the model panel.

All models of a character are given weights that are printed when visualizing models. The sum of the weights of a character model is one. It represents the importance of a particular writing style for a character.

For instance, the print below means that the displayed model for the “z” character accounts for 62% of writings of the “z” character.

![Model visualization screenshot](image)

### 6.2 Learning a recognizer

To learn a recognizer, you have to first create or load a database. There are two ways to learn the recognizer: Manual and Automatic. The Automatic or Manual mode is determined by clicking on the corresponding “Automatic” or “Manual” button at the bottom of the interface.

#### 6.2.1 Manual learning

You may manually learn character models one by one. To learn a particular character model, click on the character in the character list of the model panel then click on the “Update” button. You have to do this for all the characters you wish to recognize. All characters whose models are not learned cannot be recognized.

You may check whether a character model is learned or not by looking if there is a star in the character list. In the figure below, models of characters a, c, d, e, etc are not learned whereas model of b is learned.
You may also launch learning for all characters with a single click on the “Update All” button.

6.2.2 Automatic learning

When automatic learning mode is activated, models are automatically learned or updated each time you add a new sample or a new character.

6.3 Recognizing

If you want to test the recognizer, first draw a sample in the drawing area, then click on the recognize button (lower right of the interface). The results are displayed, including the recognized symbol and a list of closest symbols.

The results include scores for each symbol hypothesis. The highest the score, the better the model matches the drawn sample.

7 More information

If you wish some more information about this system you may read our publications and/or contact us: Thierry.Artieres@lip6.fr.
8 Main publications about this system and underlying technology

2004, Handling spatial information in on-line handwriting recognition, In *IWFHR*, Marukatat (Sanparith), Artières (Thierry)

2004 , A generic approach for on-line handwriting recognition, In *IWFHR*, Marukatat (Sanparith), Artières (Thierry), Gallinari (Patrick)

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2000, Multi-modal segmental models for on-line hanwriting recognition, In *International Conference on Pattern Recognition (ICPR)*, Artières (Thierry), Marchand (J-M.), Gallinari (Patrick), Dorizzi (Bernadette)

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