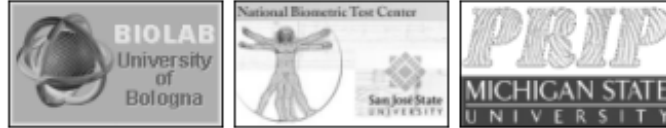


## Call for participation

# FVC2002: Fingerprint Verification Competition 2002



WEB SITE: <http://bias.csr.unibo.it/fvc2002/>

The Biometric System Lab (University of Bologna), the Pattern Recognition and Image Processing Laboratory of Michigan State University and the U.S. National Biometric Test Center (San Jose State University) are pleased to announce **FVC2002** (the Second International Fingerprint Verification Competition).

FVC2002 results will be presented at the 16<sup>th</sup> International Conference on Pattern Recognition (ICPR 2002 - <http://www.icpr2002.gel.ulaval.ca>) which will be held in Quebec City (Canada), August 11-15, 2002. The FVC2002 competition focuses only on the fingerprint verification software. Databases collected with various sensors will be provided by the competition organizers to the participants..

### **BACKGROUND**

The first international competition on fingerprint verification (FVC2000) was organized in 2000. This event received a great attention both from academic and industrial biometric communities. While on the one hand, it established a common benchmark allowing developers to unambiguously compare their algorithms, on the other hand it provided an overview of the state-of-the-art in fingerprint recognition. FVC2000 was undoubtedly a successful initiative as evident by the following:

- 11 organizations participated in the contest
- 4 different fingerprint databases were collected
- The results were presented at ICPR 2000 (International Conference on Pattern Recognition), Barcelona, September 2000.
- A detailed technical report was prepared and made available on the web. The report presents motivation, protocol, database collection, experiments and results of FVC2000.
- A CD ROM containing the four fingerprint databases and the report was prepared and more than 70 copies have been purchased by major institutions and companies working in biometrics.
- A web site has been created and maintained (<http://bias.csr.unibo.it/fvc2000/>); this web site has been visited more than 10,000 times since September 14, 2000.
- A paper on FVC2000 has been accepted for publication in an upcoming issue of the *IEEE Transaction on Pattern Analysis Machine Intelligence (PAMI)*.
- Several scientific groups are currently using FVC2000 databases in their experiments.
- Some companies which initially did not participate to the competition have requested us to certify their performance and to be added to the web site.

The interest aroused by FVC2000 and the encouragements received, induced the organizers to schedule a new competition for 2002.

### *AIM*

The continuous advances in the biometric system field and, in particular, in fingerprint techniques (both for recognition approaches and sensing devices), quickly make the performance evaluation initiatives obsolete.

The aim of this competition is to track recent advances in fingerprint verification, for both academia and industry, and to provide up to date state-of-the-art in fingerprint technology.

This competition should not be conceived as an official performance certification of biometric systems, since:

- the databases used in this contest have not been necessarily acquired in a real environment and according to a formal protocol.
- only parts of the system software will be evaluated by using images from sensors not native to each system.

In any event, the results obtained will give a useful overview of the state-of-the-art in this field and will provide guidance to the participants for improving their algorithms.

### *ORGANIZERS*

BIOMETRIC SYSTEM LAB  
UNIVERSITY OF BOLOGNA

Prof. D. Maio  
Dr. D. Maltoni  
Dr. R. Cappelli

PATTERN RECOGNITION AND IMAGE PROCESSING LAB.  
MICHIGAN STATE UNIVERSITY

Prof. A.K. Jain

U.S. NATIONAL BIOMETRIC TEST CENTER  
SAN JOSE STATE UNIVERSITY

Dr. J.L. Wayman

### *PARTICIPANTS*

- Participants can be from academia or industry.
- **Anonymous participation will be accepted:** participants will be allowed to decide whether or not to publish their names together with their system's performance. Each participant will be confidentially informed about its performance before it will be required to take the decision. In case a participant decides to remain anonymous, the label "Anonymous organization" will be used, and the real identity will not be revealed.
- Organizers of FVC2002 will not participate in the contest.

### *DATABASES*

The most important part of any test of a biometric device is the data collection effort. One of our aims is to create a multi-database, where each component database is created by using fingerprints collected with a different sensor.

- Four distinct databases, provided by the organizers, will constitute the benchmark: DB1, DB2, DB3 and DB4. Each database is **110** fingers wide and **8** samples per finger in depth (i.e., it

consists of 880 fingerprint images). Each database will be partitioned in two disjoint subsets **A** and **B**:

- the subsets DB1-A, DB2-A, DB3-A and DB4-A, which contain the first 100 fingers (800 images) of DB1, DB2, DB3 and DB4, respectively, will be used for the algorithm performance evaluation.
- the subsets DB1-B, DB2-B, DB3-B and DB4-B, containing the last 10 fingers (80 images) of DB1, DB2, DB3 and DB4, respectively, will be made available to the participants to allow parameter tuning before executable(s) submission.
- During performance evaluation, only homogeneous fingerprints, i.e. belonging to the same database, will be matched against each other.
- The image format is TIF, 256 gray-level, uncompressed.
- The image resolution, which could slightly change depending on the database, is about 500 dpi.
- The image size varies depending on the database.
- The orientation of fingerprint is approximately in the range  $[-15^\circ, +15^\circ]$  with respect to the vertical orientation.
- Each pair of samples of the same finger will have a non-null overlap, but the presence of the fingerprint cores and deltas is not guaranteed.

#### ***EXECUTABLES SUBMISSION***

- Each participant is required to submit **two** executables in the form of **Win32 console application**.
- Both the executables will take the input from command-line arguments and will append the output to a text file.
- The inputs include a database-specific configuration file; in fact, participants are allowed to submit 4 distinct configuration files `db1.cfg`, `db2.cfg`, `db3.cfg` and `db4.cfg` (one for each database) in order to adjust the algorithm's internal parameters according to each specific database. Configuration files can be text files or binary files and their I/O is responsibility of the participant code. Configuration files can also contain pre-computed data to save time during enrollment and matching.
- The first executable (`ENROLL_XXXX`) enrolls a fingerprint image and produces a template file; the command-line syntax is:

```
ENROLL_XXXX imagefile templatefile configfile outputfile
```

where:

`XXXX`: is the participant id  
`imagefile`: is the input TIF image pathname  
`templatefile`: is the output template pathname  
`configfile`: is the configuration file pathname  
`outputfile`: is the output text-file where a log string (of the form `imagefile templatefile result`) must be appended; `result` is "OK" if the enrollment can be performed or "FAIL" if the input image cannot be processed by the algorithm.

- The second executable (`MATCH_XXXX`) matches a fingerprint image against a fingerprint template and produces a similarity score; the command-line syntax is:

```
MATCH_XXXX imagefile templatefile configfile outputfile
```

where:

**xxxx:** is the participant id  
**imagefile:** is the input TIF image pathname  
**templatefile:** is the input template pathname  
**configfile:** is the configuration file pathname  
**outputfile:** is the output text-file where a log string (of the form **imagefile templatefile result similarity**) must be appended; **result** is "OK" if the matching can be performed or "FAIL" if the matching cannot be executed by the algorithm; **similarity** is a floating point value ranging from 0 to 1 which indicates the similarity between the template and the fingerprint: 0 means no similarity, 1 maximum similarity.

- Two C-language skeletons for ENROLL\_XXXX and MATCH\_XXXX are available on-line (<http://bias.csr.unibo.it/fvc2002/>) to reduce the participants' implementation efforts. These source files will perform all the necessary I/O (including TIF image loading).
- For practical testing reasons we must limit the maximum response time of the algorithms as follows: the maximum time for each enrollment is **10** seconds, the maximum time for each matching is **5** seconds. The test will be executed under Windows 2000 O.S. on Pentium III - 933 MHz machines.
- *The executables submitted by participants will be kept strictly confidential and will not be used outside the aim of FVC2002.* Furthermore, participants are allowed to protect their executables by using: expiration-date mechanisms, dongles, hardware dependent mechanisms, etc.

### **PERFORMANCE EVALUATION**

- For each database and for each algorithm:
  - Each sample in the subset A is matched against the remaining samples of the same finger to compute the **False Non Match Rate FNMR** (also referred as False Rejection Rate - FRR). If the matching  $g$  against  $h$  is performed, the symmetric one (i.e.,  $h$  against  $g$ ) is not executed to avoid correlation. The total number of *genuine* tests (in case no enrollment rejections occur) is:  $((8*7) / 2) * 100 = 2,800$
  - The first sample of each finger in the subset A is matched against the first sample of the remaining fingers in A to compute the **False Match Rate FMR** (also referred as False Acceptance Rate - FAR). If the matching  $g$  against  $h$  is performed, the symmetric one (i.e.,  $h$  against  $g$ ) is not executed to avoid correlation. The total number of false acceptance tests (in case no enrollment rejections occur) is:  $((100*99) / 2) = 4,950$
- For each participant algorithm, the following performance indicators will be reported:
  - FMR(t)/FNMR(t) curves for each database, where  $t \in [0,1]$  is the acceptance threshold.
  - ROC(t) curve for each database.
  - EER (equal-error-rate) for each database.
  - Average EER (AEER) over the 4 distinct databases.
  - Average enrollment time for each database, and over the four databases.
  - Average matching time for each database, and over the four databases.
- Performance evaluation will be executed off-line, before the FVC2002 official date (August 11 2002) when the final results will be presented and discussed. In this way, the organizers will have the time to provide feedback to the participants.

**REGISTRATION**

- Participants can register on-line (strongly encouraged) at **web site: <http://bias.csr.unibo.it/fvc2002/>** or by e-mailing to **[fvc2002@csr.unibo.it](mailto:fvc2002@csr.unibo.it)** the registration form at the end of this document.
- No fees are due for participating in FVC2002, although a regular registration for ICPR2002 is required to attend the FVC2002 results presentation.

**IMPORTANT DATES**

- Participant registration deadline: **January 10, 2002**
- The B-databases subsets will be available online **by January 15, 2002**
- Executable algorithm submission deadline: **March 1, 2002**

**PROCEEDINGS**

- A paper summarizing the results of FVC2002 will be published in the ICPR2002 proceedings.
- One CD-ROM will be created from the contest databases.
- A copy of the CD-ROM will be given to each participant at no charge.
- Non-participants may purchase one copy of the benchmark CD ROM.

**REGISTRATION FOR EXECUTABLE ALGORITHM SUBMISSION**

An on-line registration at **<http://bias.csr.unibo.it/fvc2002/>** is strongly encouraged; in case of problems with the above web site, the following registration form can be sent by e-mail to: [fvc2002@csr.unibo.it](mailto:fvc2002@csr.unibo.it)

I will submit an algorithm to FVC2002

Name: .....

E-mail: .....

Organization: .....

Academic     Company

For further information, visit: **<http://bias.csr.unibo.it/fvc2002/>**  
or contact (by email): **[fvc2002@csr.unibo.it](mailto:fvc2002@csr.unibo.it)**