

Call for participation

FVC2004: Fingerprint Verification Competition 2004



WEB SITE: <http://bias.csr.unibo.it/fvc2004/>

The Biometric System Lab (University of Bologna), the Pattern Recognition and Image Processing Laboratory of Michigan State University and San Jose State University are pleased to announce **FVC2004** (the Third International Fingerprint Verification Competition).

FVC2004 results will be firstly presented at the International Conference on Biometric Authentication (ICBA 2004 - <http://www4.comp.polyu.edu.hk/~icba/>) January 8-10, 2004. The FVC2004 competition focuses on fingerprint verification software. Databases collected with various sensors will be provided by the competition organizers to the participants.

BACKGROUND

The first and second international competitions on fingerprint verification (FVC2000 and FVC2002) were organized in 2000 and 2002, respectively. These events received great attention both from academic and industrial biometric communities. They established a common benchmark allowing developers to unambiguously compare their algorithms, and provided an overview of the state-of-the-art in fingerprint recognition. FVC2000 and FVC2002 were undoubtedly successful initiatives:

	FVC2000	FVC2002
Number of Participants	11 4 industrial, 7 academic	31 21 industrial, 6 academic and 4 other
A posteriori evaluations	3	1
No. of Databases and sensors used	4 Keytronic, ST, Identicator, SFinGe	4 Identix, Biometrika, PreciseB., SFinGe
	All included in the forthcoming "Handbook of Fingerprint Recognition" by D. Maltoni, D. Maio, A.K. Jain and S. Prabhakar, Springer NY, May 2003.	
Results presented	ICPR 2000, September 2000; IEEE Trans. PAMI, March 2002	ICPR 2002, August 2002.
Website	http://bias.csr.unibo.it/fvc2000	http://bias.csr.unibo.it/fvc2002

The interest shown in FVC2000 and FVC2002 by the biometrics research community has prompted the organizers to schedule a new competition for 2004.

AIM

Continuous advances in the field of biometric systems and, in particular, in fingerprint-based systems (both in matching techniques and sensing devices) require that the performance evaluation of biometric systems be carried out at regular intervals..

The aim of FVC2004 is to track recent advances in fingerprint verification, for both academia and industry, and to benchmark the state-of-the-art in fingerprint technology.

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

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

Nonetheless, the results of this competition 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

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PATTERN RECOGNITION AND IMAGE PROCESSING LAB.
MICHIGAN STATE UNIVERSITY

Prof. A.K. Jain

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. Participants will be confidentially informed about the performance of their algorithm before they are required to make this 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 FVC2004 will not participate in the contest.

DATABASES

The most important part of any test of a biometric system 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. those 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 $[-30^\circ, +30^\circ]$ with respect to the vertical orientation.
- Each pair of images of the same finger will have a non-null overlap, but the presence of the fingerprint cores and deltas is not guaranteed.

CATEGORIES

- Two different sub-competitions (**open** category and **light** category) will be organized using the same databases.
- Each participant is allowed to submit only **one** algorithm to each category.
- The **open** category has no limits on memory requirements and template size. For practical testing reasons, the maximum response time of the algorithms is limited 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 XP Professional O.S. on PC AMD ATHLON 1600+ (1.41 GHz).
- The **light** category is intended for algorithms conceived for light architectures and therefore characterized by low computing needs, limited memory usage and small template size. The maximum time for enrollment is **0.5** seconds and the maximum time for matching is **0.3** seconds. The test will be executed under Windows XP Professional O.S. on PC AMD ATHLON 1600+ (1.41 GHz). The maximum memory that can be allocated by the processes is **4** MBytes. The maximum template size is **2** KBytes. A utility will be made available to the participants to test if their executables comply with these memory requirement.

EXECUTABLES SUBMISSION

- Each participant is required to submit, for each algorithm, **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 assigned by organizers (different ID will be assigned to the same participant in case of submission to both the categories).

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 assigned by organizers (different ID will be assigned to the same participant in case of submission to both the categories).

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/fvc2004/>) to reduce the participants’ implementation efforts. These source files will perform all the necessary I/O (including TIF image loading).
- *The executables submitted by participants will be kept strictly confidential and will not be used outside the aim of FVC2004.* 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 image *g* is matched to *h*, the symmetric match (i.e., *h* against *g*) is not executed to avoid correlation in the scores. 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 image g is matched to h , the symmetric match (i.e., h against g) is not executed to avoid correlation in the scores. The total number of false acceptance tests (in case no enrollment rejections occur) is: $((100 \times 99) / 2) = 4,950$
- For each participating 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.
 - Average size and maximum size of the template created by the enrollment procedure.
 - Maximum memory allocated by the executables
- Performance evaluation will be executed off-line, before the FVC2004 official date (January 8-10 2004) where the final results will be presented. In this way, the organizers will have the time to provide feedback to the participants.

REGISTRATION

- Participants are requested to register on-line at **web site: <http://bias.csr.unibo.it/fvc2004/>** (in case of problems with on-line registration, send e-mail to **fvc2004@csr.unibo.it**).
- There are no fees for participating in FVC2004, although a regular registration for ICBA2004 is required to attend the FVC2004 results presentation.

IMPORTANT DATES

- Participant registration deadline: **October 15, 2003**
- The B-databases subsets will be available online **by October 15, 2003**
- Executable algorithm submission deadline: **November 30, 2003**

PROCEEDINGS

- A paper summarizing the results of FVC2004 will be published in the ICBA2004 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.

For further information, visit: http://bias.csr.unibo.it/fvc2004/ or contact (by email): fvc2004@csr.unibo.it
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