

## 3 TECHNOLOGY COMPONENTS

### 3.1 Signal Processing and Machine Learning Toolbox (BOB)

#### Keywords

Signal processing; machine learning; toolbox

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#### Corporate Sponsorship Program

See Section 4 of the present document

#### File reference & version number:

Software disclosure 6548

### Functional description

Bob is a signal-processing and machine learning toolbox. The toolbox is written in a mix of Python and C++ and is designed to be both efficient and to reduce development time.

### Innovative aspects

- Multi-dimensional arrays Blitz arrays (tensors up to 11 dimensions) integration
- LAPACK integration
- HDF5 scientific file format integration
- Signal processing (FFT, DCT)
- Image processing (SIFT bridge, LBP, DCT block, Gabor, Smoothing, Optical Flow, illumination normalization)
- Biometric database and protocol support
- PCA/LDA, Linear Machines, MLP, SVM bridge, k-Means, Gaussian Mixture Models, Joint Factor Analysis, Inter-Session Variability Modeling, Probabilistic Linear Discriminant Analysis
- Video support
- Performance evaluation toolkit

### Commercial application examples

- Face recognition, speaker recognition, vein recognition, multi-modal processing
- Biometrics-enabled identity management systems (Automated Border Control, Access Control, ...)
- Multi-factor authentication security systems (Critical Infrastructures, e-Banking, ...)
- Forensic Science, Video surveillance, Entertainment, Robotics, Man-Machine interaction

### More information

A. Anjos, L. El Shafey, R. Wallace, M. Günther, C. McCool, and S. Marcel. Bob: a free signal processing and machine learning toolbox for researchers, *ACM Multimedia 2012 International Conference*, 2012.

### Software & IPR status

The library is available under the BSD license:

- BOB: <http://www.idiap.ch/software/bob/>