



# COMPETITIVENESS AND INNOVATION FRAMEWORK PROGRAMME

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### **Inventory of European Training and Skills Provision**

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# 1. Project Summary

BEST Network, the Biometrics European Stakeholders Network, is a European Commission ICT Policy Support Programme centred on a European Thematic Network on Trusted information infrastructures and biometric technologies. To facilitate the latest information exchange and expert opinion, BEST Network has brought together key stakeholders including the finest experts from across the EU to determine how biometrics can most appropriately be applied in the context of the Charter of Fundamental Rights of the European Union.

BEST Network will focus on promoting the development of new policy implementation schemes through working groups and workshops. This will include the exchange of best practices, common cross border strategies and future pilot activities.

The network is divided into seven key areas/working groups (WG's):

1. Border Control and Immigration
2. Emerging applications
3. European Registered Travellers schemes
4. Biometrics and e-ID
5. Training & Education
6. Testing & Certification
7. Ethical, Legal and Socio-technical aspects

BEST Network will provide policy recommendations from these WGs .

This European Thematic Network on biometrics is based on four pillars; 1) technical, scientific, and industrial excellence; 2) legal analysis and compliance; 3) ethical awareness and sensitivity and 4) public and democratic transparency and scrutiny. The objective of BEST Network is to be instrumental in promoting the uptake of secure, convenient and trustworthy biometrics based ICT solutions for large, medium and small ID management systems.

The main objective of BEST Network is to bring together knowledge and hands-on experience with biometric deployments, addressing gaps in the gathering and dissemination of best practices, lessons learned in the scope of studies, pilots and deployments on European and Member States level.

**Deliverable D5.1 will look into European Training and Skills Provision as a precursor for identifying gaps and suggesting remedies to meet the needs in Europe.**

## 2. Introduction

Currently biometric technologies are being rolled out on a large scale (e.g. passports, public administrations, automated border control, immigration, and financial transactions). This causes an increasing need for educated and trained biometric professionals, from front end operators to project managers and system developers. As the majority of these new biometrics applications use biometrics technologies in crucial parts of the identity chain, it is important that the applications are developed and managed in a trustworthy way. For governments, system integrators and consultancies it is necessary that people are trained and educated in order to provide trust and integrity to the processes and systems, and to demonstrate transparent accountability to those whose biometrics are enrolled and/or used.

However, the number of recognised courses and academic curricula currently available is very limited. Moreover, it is quite hard to get an overview of what courses and curricula are available at all. Hence, it is hard for all the stakeholders in the biometrics eco-system to select an appropriate training provision that meet their requirements and quality criteria informed by their, often multi-disciplinary, concerns.

This first BEST WG5 deliverable tries to clarify this situation. It is set up as a framework, rather than the final overview of current training and skills provision for the reason that this provision is dynamic in order to keep track with the rapid developments in biometrics. BEST WG5 D5.1 is therefore best seen as an initial draft of a work in progress document.

The sources of material used for this document come from WG5 members and their networks and from the helpful information provided by members of all other BEST working groups. WG5 conducted a face-to-face meeting with its members – its first WG5 Workshop on the 11th of June 2010 at Canterbury, UK - to gather the initial information and to create a definition for the framework as laid down in this document. Further meetings are contemplated to further enhance and improve this framework.

## 3. Training and Skills Provision

In this chapter an overview is given of the currently identified types of training and skills provision. The focus is on European Provision, with the exception of Section 3.5 which will focus on international provision with an emphasis on online and interactive material accessible in Europe.

### 3.1. *Course Categories/Delivery Modalities:*

It is important to try and distinguish various types of knowledge provision currently available in the field of biometrics. Such categorisation will allow different provision to be matched to different users and application areas as appropriate. However, it must be realised that these categorisations are not always 'crisp' but may be indeed 'fuzzy' and sometimes overlap.

A list of possible categories is provided below:

- **Academic vs. Non-Academic:** academic courses and programmes are usually delivered at universities and lead to degree qualifications. They could be at undergraduate or postgraduate levels (see below). Non-academic courses are often shorter in duration and are aimed at particular vocational sectors, often as part of continuing professional development programmes.
- **Technical vs. Socio-Legal:** as biometrics has become a truly multidisciplinary subject the range of knowledge that is to be learnt can span from highly technical mathematics and physical topics at one end to deeply politico-legal and ethical issues at the other. Therefore courses may focus more on one or the other end of this spectrum.
- **Online vs. Offline:** with the widespread availability of internet and high-bandwidth connections, it is now possible to deliver and receive rich learning experiences online. This is also true for the study of and training in biometrics. While most of the online material may be aimed at non-academic training, academic institutions are also producing online material to facilitate the learning process.
- **Examined/Certified vs. Unexamined/Un-certified:** the training and education provided may also be examined and certified by some educational, professional or other authority. Certification normally provides an indicator of a specific level of competence and may be interpreted by someone employing the holder of a certificate as a measure of confidence in the knowledge and understanding that person can be expected to possess.
- **Free vs. Charged:** while often there will be a direct cost associated with receiving the training, there is also an emerging provision of free training material – often delivered online. Many universities are making a range of their lectures and course notes publicly available through the internet and media such as YouTube.
- **Short vs. Long Duration:** The length of the course can have a big impact on take up. Short course often suit continued professional development for people who may be in full-time employment.

- **Internal vs. Open:** While many courses, particularly academic ones, are open to all there are also courses that are designed for a particular organisation and audience and delivered exclusively to them. Such closed courses can be tailored to best match the needs of particular projects and organisational objectives. They can be focused and short but may be more expensive than open alternatives.
- **Practical vs. Theoretical:** a course may elaborate on technical, socio-legal or business topics or provide information on the usage or application of biometric systems and technology.

Some of these categories are further explained below and some examples of the currently available provision are listed in the Appendix.

## **3.2. Academic Courses**

### **3.2.1 Undergraduate Courses**

Most academic provision in Europe is currently at the postgraduate (MSc and PhD) levels. However, there are isolated examples of modules covering biometric technologies at the undergraduate level. There is a sharp distinction between the content of those courses depending on whether they are taught within engineering or science faculties or within social sciences. This is true in Germany, the Netherlands, Greece and the UK for example. The subject of biometrics used for border controls is also beginning to be covered increasingly in the UK at undergraduate and postgraduate levels within courses on sociology, aspects of European studies, international relations, politics, policing and migration law.

Often more generic undergraduate courses can provide technical underpinnings through courses on mathematics, image processing, computer vision and pattern recognition that can be built upon further by industrial experience and further study to provide a foundation for knowledge of biometrics systems.

### **3.2.2 Masters Level Courses**

At the Masters level there is a range of provision that has emerged in recent years. Some examples of these include masters level courses and programmes in biometrics at the University of Twente in The Netherlands, University of Bogazici in Turkey and University of Kent, in UK.

The MSc in Information Security and Biometrics at the University of Kent, for example, was one of the first masters programmes in the UK with a focus on biometrics. This one-year course started in 2006 and has been recruiting from students from Europe and internationally ever since.

### **3.2.3 Doctoral Level Courses**

Examples of provision targeting doctoral level students also exist in Europe. The most prominent one of these is the International Biometrics Summer School that has been held in Alghero, Sardinia since 2003 (<http://biometrics.uniss.it/>).

The course is usually held over the period of one week and brings together about 20 international experts from industry and academia and about 50 students for a focused period of study and exchange.

Other European postgraduate summer schools also exist and address fundamental technologies that support biometrics such as pattern recognition techniques. Conferences and annual specialised courses that involve doctoral students are also run in conjunction with industry (e.g. in Sophia Antipolis, France) and through major players like the Fraunhofer institute in Darmstadt, Germany.

### **3.3. *Non-Academic and Continuing Education Courses***

Non-academic and continuing education courses can provide an important means for knowledge transfer in this fast growing field – especially when students cannot set aside long periods for academic study or need to be working while studying.

Some universities offer modules from their academic programmes for Continuing Professional Development (CPD). An example of this has been the University of Kent in the UK that has had some of its Masters Level biometrics module available as CPD courses (<http://www.ceesi.ac.uk/mod-spec/biometricsandsecurity.html>).

While the focus of such courses is often the engineering aspects of the technology but issues such as the industrial context of biometrics and the legal and societal issues affecting the use of biometrics are also outlined.

Other commercial courses are available across Europe starting from one day introductory courses to extended bespoke provision (see Appendix).

### **3.4. *Online Courses***

There is a growing range of material available for learning about various aspects of biometrics technologies online. This includes technical and scientific papers and tutorials and much of this material is available free of charge.

Online courses, including video and interactive material, are also emerging and are likely to be an important part of the overall training “ecosystem” for biometrics.

### **3.5. *Vocational Qualifications***

An important ingredient in knowledge transfer for biometrics, as in other fields, is being able to ensure the attainment of a definite level of expertise and knowledge. This can be done through certification by a recognised authority. In the case of biometrics, the US based, Institute of Electrical and Electronic Engineers, IEEE Certified Biometrics Professional (CBP) Programme is an important recent initiative in this direction (<http://www.ieeebiometricscertification.org/>).

### **3.6. Other International Provision**

Intense activity in the area of biometrics training and education has been taking place outside Europe and some of this may be worthy of attention as Europe plans its future provision in this important area. Some examples of interesting initiatives highlighted by BEST Network members are included below:

- **USA: Purdue University's** Biometrics Standards, Performance, and Assurance Laboratory (BSPA) is offering its graduate level class on biometric technologies and applications in a distance education format. This educational programme offers a private virtual classroom that provides a high level of flexibility to the participants. This course is designed for individuals who want to learn about biometric technologies and its applications. The course will last 16 weeks and will follow semester system at Purdue University. (<http://www.bspalabs.org/wp-content/uploads/2009/10/Biometrics-Grad-Credit-Brochure.pdf>).
- **Singapore:** the **National University of Singapore's** research centres also focus on doctoral training in the engineering aspects of biometrics.
- **USA: Davenport University** and **West Virginia University** offer undergraduate degrees with majors in Biometric Security  
(<https://www.davenport.edu/Default.aspx?TabId=143&sid=0&pid=208>)  
(<http://www.lcsee.cemr.wvu.edu/ugrad/degree-info.php?degree=bsbs>)

## **4. Registry of Training and Skills Provision**

### **4.1. *The need for information update***

The landscape of courses and training provisions in the field of biometrics is fast changing and rapidly expanding. It is therefore impossible to provide a useful account of the available provision through a static document which may be updated once in a while. Rather there is the need to establish a dynamic repository of information which is continuously updated with the latest information on course/training availability, content, quality estimates and reviews.

This section outlines a possible approach to establishing such an information repository.

### **4.2. *Outline of an Online Registry***

#### **4.2.1. European Register of Biometric Training and Education**

An online web site will be established that will be continuously updated to include latest courses and training provision available across Europe and beyond. This information can be updated by providers and users of such provision and will be searchable to facilitate the rapid discovery of appropriate provision for each user's needs.

#### **4.2.2. Registration Authority – EBF**

The Registry will need to be hosted and maintained by some authority. The European Biometrics Forum may be a suitable custodian for this service and its potential role as the Registration Authority should be further explored.

#### **4.2.1. Format and delivery**

The site will be easy to use and search, possibly employing wiki technologies to facilitate continuous updating by a range of stake holders.

#### **4.2.2. Course Review and Accreditation**

The courses that are listed in the registry may be reviewed by the users of these courses and such reviews may be published on the web site to provide feedback.

Additionally the Registration Authority may choose to accredit certain courses to signal that they have reached a certain degree of quality. The mechanism for such Accreditation Schemes will have to be developed.

### **4.2.3. Registry Partitions**

The entries in the registry may be tagged to facilitate search for particular provision types. A scheme similar to that outlined in Section 3.1 may be used for labelling courses.

### **4.2.4. European Register of Biometric Professionals**

Additionally the register may include a provision for listing graduates of Accredited Courses & Certification Programmes.

Senior Professionals may apply for registration based on their Track Record. Such applicants would have to be assessed individually and a mechanism must be established for such individual registrations and for the acquisition of the status of Certified Biometric Professionals. The EBF might be the body able to evaluate and recommend CBP status.

A similar scheme of registry tags must be developed to search for professionals with specific expertise.

## **5. Conclusions**

There is a range of provision for transfer of knowledge at various levels in the field of biometrics. This includes both academic and non-academic provision. New applications and technical challenges are likely to increase the need for an expansion of this provision both in terms of reach to more students and trainees and in terms of depth of focus.

Europe appears to be in a strong position to address this growing need. However, access to information regarding what is available can be substantially improved. The proposed Registry could provide a significant boost to the ability of providers and users of biometrics knowledge thereby increasing efficiency, quality and value of knowledge provision in this important and growing field.

## 6. Appendix - Biometric Courses & Training Examples

### 'Focus' explanatory:

general	= overview, high level information
technical	= technical aspects, such as performance and statistics, basic technical principles
legal/societal	= legislation, privacy, policy, human rights, proportionality, cost/benefit
policy/design	= functional design, application development, requirements, cost/benefit
business	= business models, supply chain, commercial deployment

### 'Level' explanatory:

academic	= the course is part of an academic curriculum
academic level	= the course is provided on an academic level, but is not part of an academic curriculum
commercial	= the course is offered on a commercial basis; no indication of the level
practical	= the course addresses practical application and usage
other	= none of the above / not clear about the level

	title/ scope	offered by	subjects	focus	location	level/duration
1	Biometric Identification Science and Technology	The U.S. National Biometric Test Center / San José State University	fundamental technology, performance, statistics	general + technical	USA	Academic 3-unit Graduate level course; 12 weeks
2	Introduction to Biometrics	Biometric Security Project	Biometric orientation; Technologies; Applications; Installation and Design; Procurement, Deployment, Ownership, and Training issues	general + technical	USA	Other; 3 days
3	7. MSc Biometrics Identification Systems	the School of Electronics and Computer Science (ECS) at the University of Westminster and the Department of IEM, University of Applied Sciences Giessen-Friedberg, Germany	Biometric Identification Systems • Biometrics Project • Forensic Aspects of Biometrics • Intelligent Computing • Programming for Biometrics • Research Methods • Testing and Evaluation • Visual Recognition Systems	technical	UK, Germany	Academic MSc, Certificate IV in Biometric Technologies (80914ACT); 15-month, full-time or from 25 months to five years, part-time block mode
4	Introduction to Biometrics The Essentials of Biometrics Biometrics for Access Control and Time & Attendance	Jarcom Biometrics Training and Consulting	general technical issues, application specific	general	UK	Commercial; 1 day + 2 days
5	Applying Biometrics Intensive Course	Biometrics Institute	theory, algorithms, applications and standards of biometric identification	technical	Australia, Singapore	Academic level; 4 days
6	Forensics, Security and Remote Identification	Summer School for Advanced Studies on Biometrics for Secure Authentication	basics on a variety of biometric modalities, integration strategies	technical	Italy	Academic level/Commercial; 5 days
7	PKI and Biometrics	Vale Training Consultants	PKI and biometrics for identity access management and access control	technical	UK	Commercial; 2 days
8	Biometrics	Inhousetraining (IE) in cooperation with Buffalo University (USA)	biometric basics	general/technical	Ireland, USA	Other (University Accredited); online course/online exam
9	Biometrics & Privacy	Inhousetraining (IE) in cooperation with Buffalo University (USA)	biometric basics, legal (EU+US), privacy	general/technical, legal/societal	Ireland, USA	Other (University Accredited); online course/online exam
10	Biometric Course	BSPA Labs, Purdue	biometric terms and	technical	USA	Other; 1 year; online

	(on-line, Certificate of Completion)	University	methodologies, biometric systems design, systems evaluation			course
11	Biometrics and Forensics	High Tech Crime Institute (HTCI)	technical from a forensic point of view	technical	USA	Other; 4 days
12	Understanding Biometrics	Pattern Recognition and Machine Intelligence Association (PREMIA)	introduction to biometrics; high level information with a technical focus	technical	Singapore	Academic Level; 1 day
13	Biometrics in Depth	Pattern Recognition and Machine Intelligence Association (PREMIA)	overview of technical principles of different modalities	technical	Singapore	Academic Level; 2 days
14	Certificate IV in Biometric Technologies	The Canberra Institute of Technology (CIT)	practical training in biometrics	technical	Australia	Academic; MSc Certificate IV in Biometric Technologies (80914ACT); 12-18 months full time
15	IEEE Certified Biometric Professional (CBP)	IEEE	standardized baseline of knowledge in the biometrics industry	technical	USA/international	Academic level; online course and exam
16	Biometrics Basics	West Virginia University + Center for Identification Technology Research (CITeR)	biometrics basics	technical	USA	Academic (graduate and undergraduate programs)
17	Essentials of Biometrics	Identity Solutions Ltd	basics on biometrics	technical	UK	Other/Commercial; 1 day training
18	Biometric Identification: Theory, Algorithms, and Implementation	UCLA Master of Science in Engineering, University of California	history, theory, algorithms, applications, and standards of biometric recognition	technical	USA	Academic Level; 3 days course
19	Biometric Training Programme	Simply Biometrics	Commercial aspects, system integration (hw, sw)	technical	UK	Other/Commercial; certification claimed; 1 day
20	Certified Biometrics Security Professional	CertFirst Integrated Knowledge Solutions	general introduction to biometrics, biometric modalities, high level technical overview (focus on integration and application)	technical	USA	Other; certification claimed; 1 day
21	Certified Biometrics Engineer	CertFirst Integrated Knowledge Solutions	technology and application	technical	USA	Other/Commercial; certification claimed; 3 days
22	Introduction to Biometrics	Siemens	high level technical overview, Outline the key aspects of solution architecture, Review of the key vendors in each area, Discuss the integration and compatibility pitfalls.	general, technical	UK	Other/Commercial; 1 day
23	Biometrics	Department of Computing, Hong Kong Polytechnic University	introduction to biometric computing knowledge and methods; overview + fundamental techniques	technical	Hong Kong	Academic (for undergraduates & graduates); ca. 10 days incl. exam
24	Information Security and Biometrics	University of Kent	Introduction to biometric and information security technologies and associated issues.	technical	UK	Academic – MSc and Postgraduate Diploma – 1 year full-time, 2-years part-time. exam
25	Basisopleiding Biometrie (Basic Course on Biometrics)	Dutch Ministry of Justice	Course open to Dutch civil servants to train the background and use of biometrics in the justice chain	general	NL	Practical – Certification at 3 levels