

Towards Facial Recognition in Online Education

Francisco David Guillén Gámez, Iván García-Magariño y Juan Luis Rubio

Departamento de Ingeniería Informática y Organización Industrial - Facultad de Enseñanzas

Técnicas- Universidad a Distancia de Madrid

Abstract

The increasing demand of on line education sector is facing new aspects that need to be solved to make on line training as liable as face to face. One of the critical issues to consider is the possibility that the students could make exams or test at home avoiding identity impersonation. There are some approaches to the problem of face recognition from the technological point of view but we consider to analyze a new perspective that is recognizing the student while being in front of his computer. The research includes different aspects to be considered: psicological analysis, technological aspects, educational results, emotional indicators and others. In this sense, the global approach aims to answer the main question: how to minimize the error when making a facial recognition being as less intrusive as possible and improving the results of the learning process?

Keywords: face recognition, online learning, analysis of perceptions, educational results, biometrical recognition

Towards Facial Recognition in Online Education

Introduction and Background

Currently, it is possible to implement facial recognition technology in a wide variety of contexts that leads to a incremental sophistication. At the simplest level, technology can be used for recognizing faces, that means just detecting and locating faces in a photo. A more refined version, from a technological perspective, of facial recognition allows us to assess features of facial images. For instance, it is possible to identify moods or emotions from facial expressions to determine the involvement of a video game player or a spectator excitement during a movie. Although, if we talk about the most advanced applications, we could use technology to compare facial features of individuals through different images in order to identify them. This is just part of the story of biometrical recognition, as there have been several trials to solve recognition considering physical aspects of the human body (Sunil 2012, Westeyn et al 2005, Angulo et al 2012):

Comparing this approach to which we are showing in this article, we get advance in the sense of a 'non councious' permanent identification based on biometric measures: previous attempts tried to identify the person just once (for instance with its finger print or blink colour) but once the person is identified there is no tracking to assure that person keeps on being the same.

Taking into account current social needs, education is considered as a lifetime activity. This requirement is fulfilled by the online learning (e-learning). E-learning is one of the fastest growing areas of the technology sector. It is interactive and involves the use of multimedia. The term e-learning encompasses computer-based learning, online learning and virtual classrooms. E-

learning can be delivered through many electronic media like Internet, intranets, extranets, satellite broadcast, audio / video, interactive TV and CD-ROM.

When students are using e-learning technology, they play a more active role than the passive one of just a information receiver transmitted by a teacher, textbook, or broadcast. In the best case, the e-learning method is an individual and personalized way of learning which allow students to choose and review the materials at their own pace, anytime and anywhere. In the worst of cases, it can take power away and discourage students by leaving them lost and unsupported in an electronic environment immensely confusing.

E-Learning possibilities are clearly increasing day by day. It is possible today to use facial recognition software for E-Learning purposes. This software works integrated in platforms as Moodle and others. One of the advantages of this kind of tools is that they allow the system to recognize if the pupil is really the pupil or not. Therefore, it would be interesting to see through this tool how you can control who performs the activities .

In the last years, technology has been incorporated to education, and therefore, to E-Learning. There are many technologies that have been applied , and many articles and magazines that have echoed. We will focus in facial recognition and how it affects to students from different perspectives.

For example, Denhavi et al. (2011) present a system to check that students are actually attending virtual classes. It is used for identification, tracking and authentication of users. In this model, two behavioral biometric features (mouse movements and key dynamics) and a physical (facial features) are used.

Furthermore, Ullah et al. (2012) proposes a face recognition mechanism to make sure that students are not supplanted to improve their virtual test scores. They propose; the use of an authentication framework based on profiles (PBAF) along with a user ID and a password for authentication of students during online exams . The proposed solution uses security profiles based on questions which verify PBAF by developing a virtual learning environment.

Both works focus on a very specific aspect of the teaching process, the first on the class attendance and the second one on the examination.

Other studies, as the one from Eagle et al. (2008) present a face recognition tool easily integrable with existing Learning Management Systems (LMSs), thanks to a adaptable web design . Its main objective is user tracking and verification which combines face tracking, facial verification and fingerprint check.

Finally, the most remarkable analysis would be Elisardo Agulla Gonzalez's rapporteur, University of Vigo, which comes to the same technological field in "Is My Student at the Other Side? Applying Biometric Web Authentication to elearning environments" article. In this article, through the program *BioTracker*, images captured by webcam, to verify if it is the student who is behind it and not someone else.

On the other hand, the project we are working on, is focused and it will integrate the script in one of the most popular LMSs, such as Moodle, including this facial recognition in the various activities of the process, such as controls, interactive lessons, ongoing evaluation activities, learning activities, forums; and each one of them will be as well customizable by the teacher.

Motivation

The goal pursued by the present research is to valuate the introduction of this online teaching tool. The study will incorporate different aspects: technological, psychological, methodological, didactic and others.

To carry out the project, a series of questions will be designed , about everything that's related to the program. The questionnaire will be fulfilled by some of the teachers, students and even relatives to know what they think about. Once you have taken these views, it will be analyzed and compared between each one, to obtain conclusions and results that can tell us what society in general thinks about facial recognition in online education.

The piece of code that implements this facial recognition functionality works as follows: at the beginning of the course, the student is identified by taking him some photographs which are compared with some reference. During the development of the course, the student is periodically taken a photograph so the algorithm implemented can deduce if the student keeps on being the same or not. In case of doubt, it delivers a warning message to the teacher.

Something important to know is that the program has a 2% error rate, depending on the lighting that there is in the room where the student remains. When this 2% in on, it is the same company, in the appropriate department and conducted by a human person who is checking if the person is the student or not.

Analysis of the Perception of Students About Facial Recognition

The sample consists of 54 subjects, classified as follows: 37 students of the Master Degree in Elementary Education Degree, 5 Teachers belonging both to: Language School, Elementary Teacher and University Teachers, and finally 12 subjects which have already finished their degrees. All of them belonging to the province of Malaga.

The average age of participants was 22.4 years, and most women (76%) and students (85%).

Table 1: Seven-point Likert scale

| Response | Puntuation |
|----------------------------|-------------------|
| Totally disagree | 1 |
| Disagree | 2 |
| Slightly Disagree | 3 |
| Neither agree nor disagree | 4 |
| Slightly Agree | 5 |
| Agree | 6 |
| Strongly Agree | 7 |

The collection of data is another important step in the investigation since the conclusions of a study are based on such data. In most investigations, when assessing attitudes and opinions is usually used the seven-point Likert scale (see Table 1), which is what this research has to use.

The Likert scale is ordinal level and is characterized by placing a number of selected sentences on a scale with degrees of agreement / disagreement. These phrases, which the interviewee is subjected to, are arranged in batteries and have the same reaction scheme, allowing the system to learn the interviewee answers quickly.

For the creation of the questionnaire, 34 questions were carried out, classified into different groups, such as: Block 0, questions related to their academic and professional aspects, Block A, Education issues, Block B, related to online education; Block C, all that, that lies with biometrics. Table 2 presents the relevant questions of the questionnaire.

Among all those questions that have been conducted, the most valuable in terms of content has been highlighted, originality, and weight within biometrics and virtual education.

The questionnaire can be divided into two parts, those that are made through the Likert

questionnaire and all those which aren't. Below are the questions that have been raised through the scale.

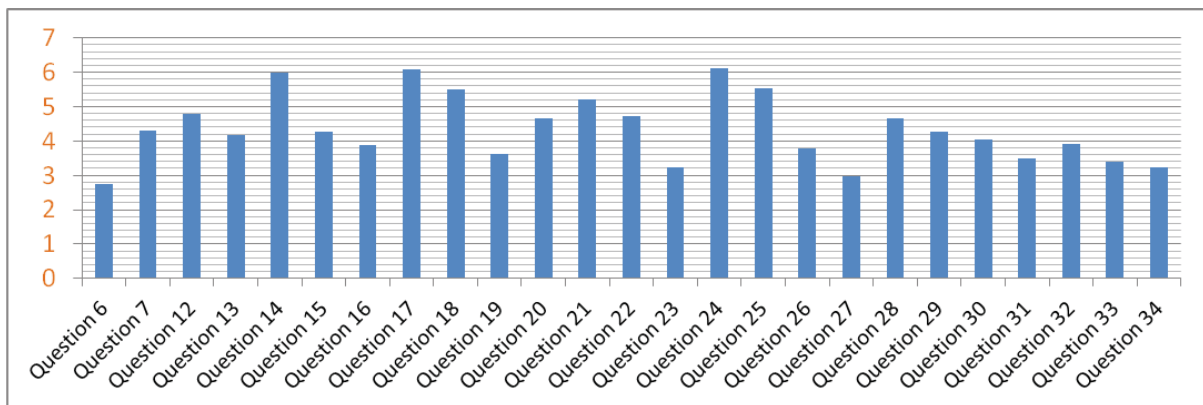
Table 2: Questions of the questionnaire

| | |
|----------|--|
| Preg. 6 | Do you think the students learn the same in the different forms of education? |
| Preg. 7 | Do you think the teacher can explain better in online education through new technologies? |
| Preg. 12 | Do you think it is a good method to identify people? |
| Preg. 13 | Would you be willing to face recognition is used in education Online? |
| Preg. 14 | Do you think it's fair for all students to check that it is he who does the work and not a fake user? |
| Preg. 15 | Do you think this method should be implemented in all online universities? |
| Preg. 16 | Would you like that one day they can make the current site exams at home by an advanced face recognition technology? |
| Preg. 17 | If we think from the point of view of the teacher, look well as to control the students not to copy? |
| Preg. 18 | Do you think you lose privacy to be observed through a Cam? |
| Preg. 19 | Will it improve the recognition method of student academic data? |
| Preg. 20 | Would you feel angry when the program is watching while doing course activities? |
| Preg. 21 | Would you feel spied when the program is watching while doing course activities? |
| Preg. 22 | Would you feel embarrassed when the program is watching while doing course activities? |
| Preg. 23 | Would you feel comfortable when you are watching the program while doing course activities? |
| Preg. 24 | Do you think the pictures taken at home can capture aspects of your personal life that you want to share? (E.g. your daughter gives you a kiss) |
| Preg. 25 | Do you think the facial recognition program is going to be an obstacle for developing your business as normal? (Forces you to be at your computer without getting up) |
| Preg. 26 | Do you think this system will encourage you not to ask for help to pass the tests and will it help you learn more? |
| Preg. 27 | Do you use someone's help generally to pass the tests or develop activities? |
| Preg. 28 | Does the fact that you need to have a webcam bothering you? |
| Preg. 29 | Do you think it is a good progress to include facial recognition tool to improve the quality of learning in distance universities? |
| Preg. 30 | Do you think a college distance will increase the prestige of the fact that an open university to ensure that students are really doing facial recognition activities? |
| Preg. 31 | Do you think it's worth the degree of the student has more prestige despite any inconvenience that may be recognized facially? |
| Preg. 32 | Do you think it is appropriate to apply facial recognition checks (made in the classroom, classroom exams different)? |
| Preg. 33 | Do you think it is appropriate to apply facial recognition to continuous assessment activities? |
| Preg. 34 | Do you think it is appropriate to apply facial recognition to learning activities? |

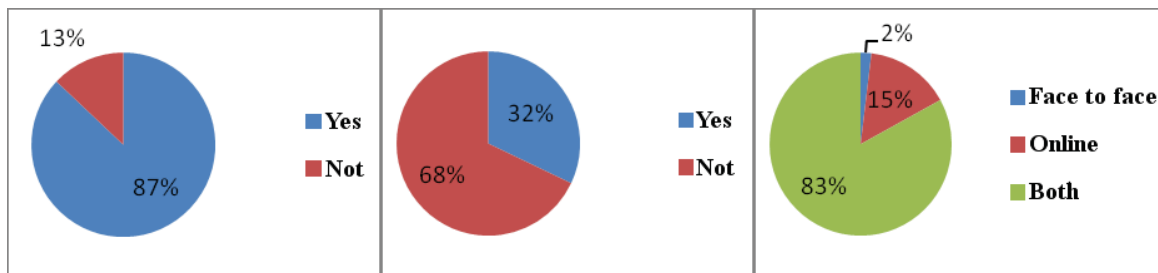
Results of the analysis

The results, in most of the survey responses, have been very positive and have been welcome. We could assume that the technological background worked in previous courses may help on top of it. While on the contrary as a remarkable fact, some questions seem to be far from the knowledge of those who participated in the experiment. Anyway everything will be analysed and compared below:

Figure 1. full Graphic



To begin to analyze the impact achieved, has joined in just a graph in Figure 1 of all related data collected and all questions that have been proposed in the questionnaire. Each question is represented with the average of all participants, for an overview. To understand each question, please find the definitions of each in the previous section so we can see the result, remembering that the result 1 is "Strongly Disagree", and conversely 7 "Strongly Agree".

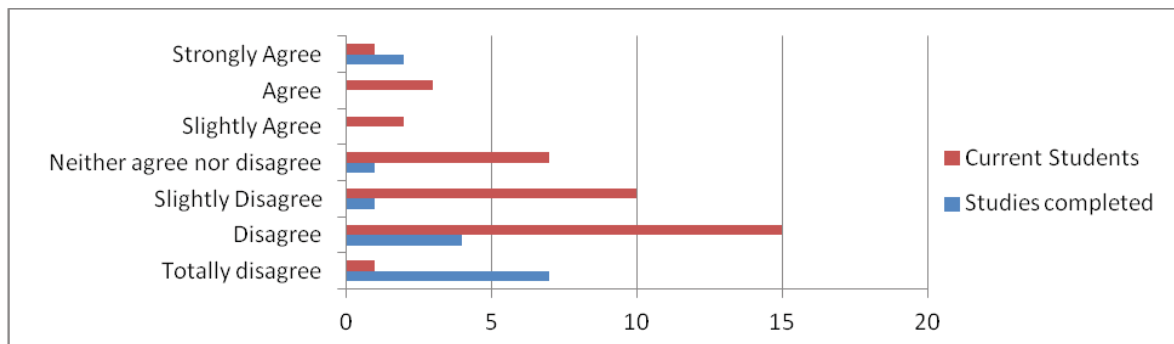


To begin the analysis and comparison of those questions that have been chosen, it is interesting to start by comparing these three graphs, as it is interesting to see the extent of information held by respondents on these three interrelated questions. The majority of the sample believed that education will continue as it is today, that is, continue to exist both (face and online).

From our point of view, finding in the century we are, having at our fingertips all kinds of resources and technological materials, as well as all the new technologies that are constantly integrated into our daily lives, we think that this sector of the population has an interest in new technologies. They "seem" traditional subjects who show no interest in it, or else have not stopped to think the two words that surround the question: virtual and education.

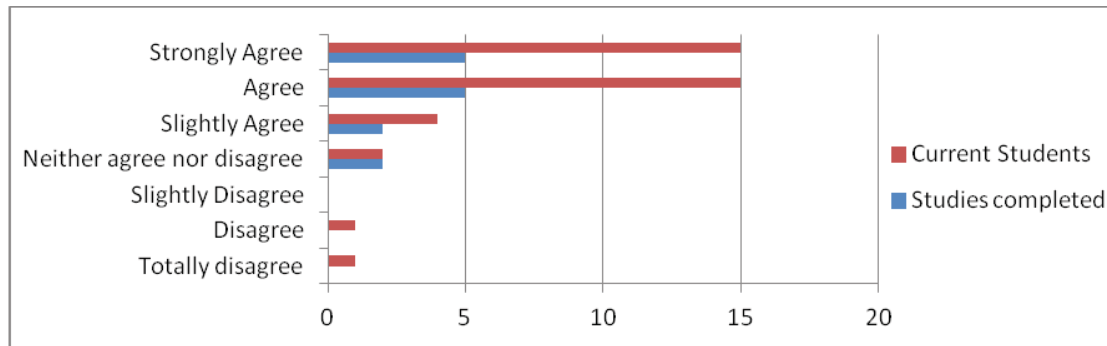
However, if we compare these two graphs with the third, we see there is a degree of inaccuracy and little contextualization, that's to say, we think the surveyed one knows what virtual education is through a platform, but on the contrary, because of their knowledge or resource scarcity you do not know that this virtual platform is using Moodle known in most universities. Investigating a little more on the subject, we can confirm that 95 % of surveyed ones have studied at the University of Málaga, which uses the Moodle platform.

Figure 5 Do you think that students learn in different ways like education?



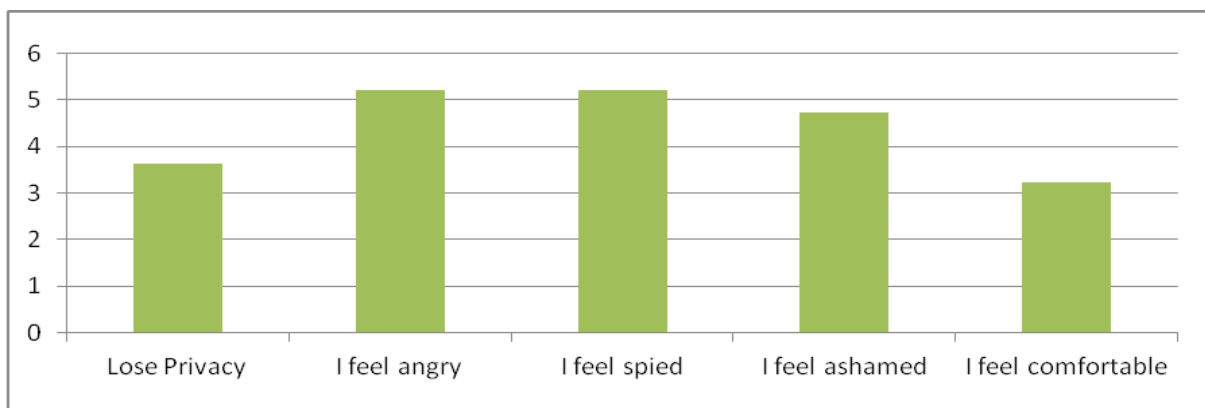
As it can be seen in Figure 5, the sample of subjects was divided between those subjects who are still being studied, and those who have already completed their training. It can be seen clearly, as the two parts believe the same way the question. A much smaller number believe that you learn the same in different types that exist (face, half face, online ..). It is observed that no matter the level of education you have, because most of them believe that they do not learn the same way.

Figure 6 Do you think it's fair for all students to check that it is he who does the chores and not a fake user?



It is clear that for all surveyed ones in the Figure 6, it is fair to control who performs the tasks and who doesn't like a fake user. It is observed that we all agree or strongly agree with this proposal.

Figure 7 Would you feel angry, comfortable, spied and embarrassed and lose intimacy when the program is watching while doing course activities?



Analysing the following questions (Figure 7) it shows clearly how all of the surveyed people think the same way. We observe that the surveyed ones do not like the idea that you observe while performing the activities. Generally, they all mean neither agree nor disagree, but if we analyze each question individually, it is clear that in this way of controlling, he observes, and not like that idea, taking some data on the scale between 2 and 3, far below the 7 "Strongly Agree", they turn up totally to disagree what you observe.

On the other hand, if we compare (Figure 5) with the previous one (Figure 6), we can see a contradiction, since all surveyed ones believe that facial recognition is a great idea to check that the user is the one who performs the activities, but they show their disagreement with the observation process.

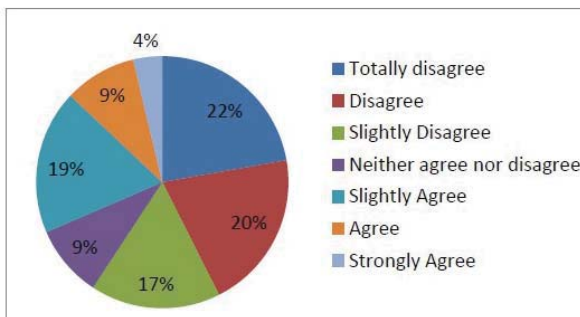


Figure 8 Do you think it is appropriate to apply facial recognition to learning activities?

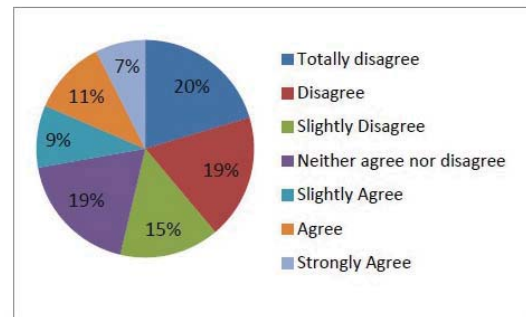


Figure 9 Do you think it is appropriate to apply facial recognition to continuous assessment activities?

In relation to the latest graphics, there is a great difference of opinion, no sector agrees that if it is right or not. Only a very low percent of surveyed people agree on applying biometrics. If we make an average between the two graphs, we would be, according to the Likert scale between levels 3 and 4, that's to say "Neither agree nor disagree". It is observed that facial recognition is a good method to recognize the student, yet they do not show any conformity to apply them to control these activities.

Conclusions and Future Work

This section presents the conclusions which have been reached in the development of this project and the results obtained through this. Similarly some future work is raised that can be based on this research. Face detection is currently a need for a few applications such as video-calling, credit cards and especially in video surveillance. Their importance grows with the consideration that is the first step in a face recognition system. Object's great looking face, makes their detection that is considered as a difficult task for pattern recognition.

The main objective set at the beginning of this thesis was to determine the degree of opinion that the introduction of facial recognition can have in online education. Many of the face detection methods share the same techniques and algorithms for pattern recognition and image analysis. One method of face detection in real time is the method of Viola and Jones.

Nevertheless, from our point of view, the problem in environmental education is not related to the system of method used for face recognition student but the rejection which still poses to the user that you somehow control while making the issues and tasks belonging to the symbol in question. The subjects of the research show that its successful line is a good method to control anyone who usurps the role of another to do the activities, but shows their displeasure about losing their privacy to be recording aspects of their lives.

The work could be extended even reaching a wider audience and real in different conferences about how we want to treat students, that is to say, the program Biotracker could be tested in a real way with students. It would be interesting to integrate this script and test the platform with a class of students studying any subject online. Checking if the program works correctly, and in turn, learning information about how the students feel at that time when doing the activities with a Cam capturing images of themselves.

Acknowledgments

This work has been done in the context of the research project *Desarrollo de un módulo de autenticación y monitorización biométrica de usuarios en entornos virtuales de aprendizaje*, supported by the *Universidad a Distancia de Madrid*. This research work has also been funded by the Spanish Ministry for Economy and Competitiveness through the project *Social Ambient Assisting Living - Methods (SociAAL)* (TIN2011-28335-C02-01).

References

- Brunelli, Roberto. Template matching. *Pattern Recognition*. Pp 751- 768. 1997
- Agulla, E. G., Rifón, L. A., Castro, J. L. A., & Mateo, C. G. (2008, July). Is My Student at the Other Side? Applying Biometric Web Authentication to E-Learning Environments. In *Advanced Learning Technologies, 2008. ICALT'08. Eighth IEEE International Conference on* (pp. 551-553). IEEE.
- Dehnavi, M. K., & Fard, N. P. (2011). Presenting a multimodal biometric model for tracking the students in virtual classes. *Procedia-Social and Behavioral Sciences*, 15, 3456-3462.
- Ullah, A., Xiao, H., & Lilley, M. (2012, June). Profile based student authentication in online examination. In *Information Society (i-Society), 2012 International Conference on* (pp. 109-113). IEEE.
- Agulla, E. G., & J. L. Alba Castro, & E. Argones Rúa, (2011, November). Multimodal Biometrics-based Student Attendance Measurement in Learning Management Systems. *Signal Theory and Communications Department, University of Vigo*
- Dehnavi, M. K., & Sharafi, S. M., & Nematbakhsh, N. (2011) Developing a e-learning model for tracking the continuous attendance of the students.
- Mary Lourde R., Dushyant K., "Fingerprint Identification in Biometric Security Systems" *Journal of Computer and Electrical Engineering (IJCEE)*, vol 2, no 5, October, 2010.
- Sunil, L. (2012). Biometric identification and verification techniques -A future of ATM Banking System. *Indian Streams Research Journal; Aug 2012, Vol. 2 Issue 7*.
- Gil, C. Castro, M.; Wyne, M. (2010). Identification in Web Evaluation in Learning Management System by Fingerprint Identification System
- Chen, H. (2010) Design of web-based e-learnig system based on monitoring facial expressions: detection mechanism of learners' attention. *Journal of Computer and Information Technology Vol.2, No.1*.
- The Scottish Government (2010). biometric identification systems in schools guidance for education authorities, learning establishments and schools
- Westeyn, T., & Pesti, P., & Park, K., & Starner, T (2005) Biometric identification using song-based eye blink patterns
- Penteadó, B. P., & Marana, A. N. (2010). A video-based biometric authentication for elearning web applications.
- Angulo, J. & Wastlung, E. (2012). Exploring Touch-screen Biometrics for User Identification on Smart Phones. *Privacy and Identity Management for Life IFIP Advances in Information and Communication Technology Volume 375, 2012, pp 130-143*.