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Fabrice Meriaudeau, David Fofi, Alice Meriaudeau, Herma Adema-Labille,  
Valerie Torres, Alain Trémeau, Renato Zaccaria, Valentina Resaz

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## **European Programs and their Extension in the Field of Computer Vision, Color and Robotics**

**F. Meriaudeau, D. Fofi, A. Meriaudeau, H. Adema-Labille, V. Torres**

*Université de Bourgogne, Centre Universitaire Condorcet,  
720 Avenue de L'Europe, 71200 le Creusot, France, phone: +33 (0)3 85 77 00 71, e-mail: fmeriau@u-bourgogne.fr*

**A. Tremeau**

*Université Jean Monnet, Faculty of Science and Technology,  
Bat B, 18 rue Professeur Lauras, 42 000 St Etienne, France, phone: +33 (0)4 77 91 57 52,  
e-mail: alain.tremeau@univ-st-etienne.fr*

**R. Zaccaria, V. Resaz**

*Università degli Studi di Genova, Facoltà di Ingegneria,  
Via Opera Pia 13, 16145 Genova, Italy, phone: +39 (010) 353 2798, e-mail : renato.zaccaria@unige.it*

### **Introduction**

Over the last 4 years, the University of Burgundy (uB) has intensified its international oriented actions in the field of Computer Vision and Robotics through further development of the educational network, partnerships, programs and communication. The creation of European programs, such as the Erasmus Mundus program and the Thematic Networks (Life Long Learning) allowed us to develop new programs, building up valuable academic and project administration experience as well as developing new actions for incoming foreign students.

In this paper we describe some of our activities and those of the University of Saint Etienne (UJM) and University of Genova (UNIGE), and their respective consortia, that join a few of the suggested topics in the call for paper:

- the Europe-based academic Erasmus Mundus excellence programs in the field of Computer Vision, Color and Robotics *VIBOT* [1], *CIMET* [2] and *EMARO* [3];
- the non Erasmus Mundus English taught *MSc Computer Vision* [4] program provided by the uB;
- the involvement of companies in these programs;
- the various consortia and the newly set up (bilateral) partnerships as well as the extension to the Doctorate Level;
- the communication project that focuses on general enhancement of attractiveness of the European curricula taking into account students, companies and higher education institutions needs.

### **European curricula**

The above mentioned universities and consortia offer the following English taught master courses in the field of EIE:

*VIBOT*. The European Erasmus Mundus Master course on Computer Vision and Robotics ([VIBOT](http://www.vibot.org), [www.vibot.org](http://www.vibot.org)) offers the opportunity to highly motivated, excellent students around the world to take up MSc courses in the field of Computer Vision and Robotics and receive an Erasmus Mundus grant.

This program strives for excellence in terms of teaching, research methods and results, and is proposed by a consortium of three universities: Heriot Watt University (Scotland), University of Girona (Spain) and uB (France), each bringing in their complementary specializations and large research networks.

In September 2009, the 4<sup>th</sup> cohort started in Scotland. Since 2006, a total of 102 international students have followed the program. The significant increase in number of applicants and corresponding number of nationalities shows the general interest for this type of excellence programs (see table 1). In the first year around 200 students applied for the EM program. This year (2010) we've received about 440 third country applications, (European applications not included yet) covering 51 nationalities.

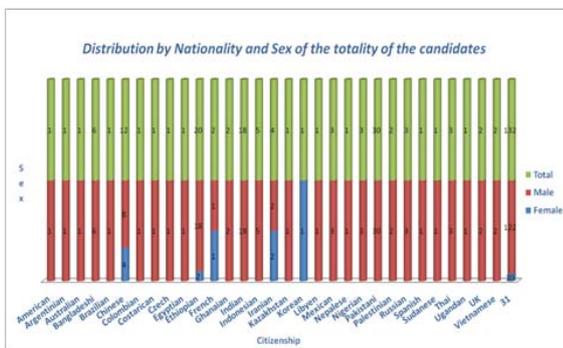
The program ensures the mobility of students through the first 3 semesters spent in the three countries, the fourth semester which is dedicated to research project can be spent anywhere in the world (depending on the grant).

Academic staff has built up valuable experience in multi-cultural group teaching, not only through the presence of international students but also through inclusion

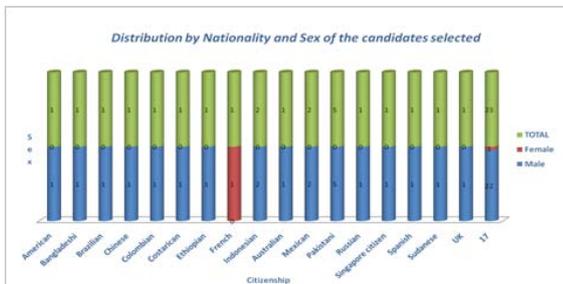
of international invited scholars (Indonesia, Malaysia, USA, Iran, Serbia, Mexico, Russia, Cameroon) involved in teaching or in research activities. The awareness of cultural aspects in training and research collaboration has enriched the teaching approaches on the one hand, and offers students an extra dimension to their course on the other hand, which will be useful in their developing their future research activities.

**Table 1.** VIBOT applicants, nationalities and selected students

	Prom 1 2006-08	Prom 2 2007-09	Prom 3 2008-10	Prom 4 2009-11	Prom 5 2010-12
number of selected Vibot Students/number of nationalities	26/15	33/17	20/17	23/17 s	Around 25 (final number pending)
total number of applicants/number of nationalities	112/27	271/33	132/31	302/38	444/51



a)



b)

**Fig. 1.** Examples of international representation (cohort 3, 2008-2010)

Consortium partners ensure quality of the program through regular streamlining of modules proposed by each university and through fine tuning of the inter university research exchanges and collaboration.

Administrative staff has built up experience in the organization of third country student hosting, dealing with administrative procedures and proposing solutions for problems encountered by the third country students. Creative thinking has allowed solving some discrepancies between internal and European administrative procedures.

#### MSc COMPUTER VISION

International students are also offered the possibility to join the two year MSc Computer Vision ([mcs-vision.u-](http://mcs-vision.u-)

[bourgogne.fr](http://bourgogne.fr)) program that was launched in 2009. This Master course is taught in English too and takes place at the Condorcet University Centre (uB) for the full duration of the program. Students can request for French mobility grants within the framework of their traineeships. Seven students (Six different nationalities) out of 49 were selected in this first year of the program. These students will then merge with the students enrolled in the VIBOT program.

*CIMET.* Within the CIMET Consortium composed of four European Universities, the University of Saint-Etienne offers and coordinates the English taught, 2-year master course “Color in Informatics and Media Technology” (CIMET, [www.master-erasmusmundus-color.eu](http://www.master-erasmusmundus-color.eu)). The curriculum covers innovative areas such as color, photonics, computer vision and imaging science, computer science and multimedia technology.

The specificities of the CIMET Master lies in the innovative pedagogical methods of teaching and learning and the Cross-European mobility scheme offered to student and teaching staff. Those two aspects are indeed enhancing the excellence and value-added of the Master program.

For instance, the synchronization of pedagogical teams allows similar course contents to be delivered simultaneously in the four universities. In addition, exams are held on the same dates offering the possibility to organize a double correction system. Furthermore, the Video conference tool is used widely for lecture delivery. Finally, Master Thesis defenses are being held on the same model, making it possible for the consortium members to evaluate each candidate.

Another key feature of the Master program is the Group project which runs over three semesters despite the geographical dispatch of students. A local supervisor among the teaching staff offers support to the group over the duration of the project. The setting is organized as “working group” enhancing the cross border cooperation skills of students.

A common pedagogical portal gathers varied academic materials such as lecture notes, exercises, practical sessions and past exams papers. It is also considered as a communication tool between students and the pedagogical teams being dispatched over the four university sites. This portal is also a tool to educate students to environment preservation since no printed copies are delivered to support lectures.

The initial intricacies of this ambitious program have not only been tackled and addressed but do account for a real asset within the students’ training scheme and a source of innovation in the pedagogical approach.

#### EMARO

European Master on Advanced Robotics (<http://emaro.irccyn.ec-nantes.fr>), is an integrated Master course promoted and managed inside the Erasmus Mundus Framework by three European institutions and three Asian institutions, namely: École Centrale de Nantes- France (coordinator), Warsaw University of Technology - Poland, University of Genova - Italy, Asian Institute of Technology - Thailand, Faculty of Science and Technology, Keio University – Japan, Shanghai Jiao Tong University – China.

Primary role of European institution is courses organization, teaching, and student management. Role of

the Asian partners is exchange of teachers, and short-term stay of students for Master Theses. The Masters is designed to promote a high-quality education in the area of advanced robotics and intelligent systems. The Emaro consortium has chosen to have the same courses in the three European institutions during the first year (first two semesters). The aim of this is to provide the students a strong interdisciplinary background across the main areas of Robotics (Cognition, Action, Perception).

During the second year, according to the research strength of each hosting institution, students will deal with specialized robotics areas such as industrial robot systems, service robots (domestic, health, rehabilitation, leisure), and space and security robots. All students must spend the first two semesters in one European institution of the consortium and the successive two semesters in another one, obtaining a double degree at the end. The language used for teaching is English, but local language and culture courses of the hosting countries are included in the curriculum of study.

During the fourth semester the student carries out his/her Masters Thesis work under the joint supervision of two tutors from two different consortium partners, either European or non European.

The consortium chose the students mobility scheme described above in order to minimize the bureaucratic and logistical problems due to visas, permits of stay, and all the inconveniences arising from changing country frequently. Moreover, a long stay in the chosen consortium institutions gives the student a real chance to broaden his/her knowledge of the host country, through language courses and cultural events organized by each partner.

Exposure to different teaching models is still guaranteed to students, since the consortium has a strong teacher staff mobility (both at European level and worldwide). Furthermore, having a curriculum largely shared, the consortium is exploring ways to deliver a single joint degree with legal value in all the partner nations.

With respect to the all-European partner consortia, the added value given to the EMARO consortium from the Asian partners is:

- a solid academic exchange program,
- a continuous transfer of research expertise and teaching methods in advanced robotics between the European and third-country partners,
- a rich offer of supplementary specialization courses for all the partners.

In the 2009-2010 academic year (second year since its start) EMARO will graduate its first group of students. In the first two years the numbers of the consortium have been as shown in the table 2.

**Table 2.** Numbers of the consortium

	A.A.20	A.A.2009-
Emaro selected students	29	32
Students nationality	17	20
No. application to the Eu	354	341
No. Eu scholarships granted	20	19

**DOUBLE DEGREES.** Double degrees (one year abroad, one year in France) have been established by the uB with the University of Gunadarma (Indonesia) and are currently being finalized with the Malaysian universities Universiti Teknologi Malaysia and Universiti Teknologi Petronas.

Students are also offered an opportunity to spend one year in the USA (University of Tennessee Knoxville, based on student exchange agreement).

**VISOR [5].** The extension of the VIBOT program with the CIMET is to propose an excellence program at the PhD level named VISOR (<http://www.u-bourgogne.fr/condorcet/visor/>), including strong relations with private research centers and industry. This initiatives relies on seven European partners involved in 5 different countries (Finland, Norway, Spain, Scotland and France).

## Companies

The European master on Computer Vision and Robotics (*VIBOT*) and the University of Burgundy's English *MSc Computer Vision* program meet the present needs of industry for quality control and automation of industrial processes as well as in the field of health with the ever increasing importance of medical imaging in all its forms. The results obtained by the teams of researchers quickly find outlets in industry.

Letters of support issued by various private research companies and industry formalize the relationship between the master program and the companies.

VIBOT/The consortium members organize in turns the "VIBOT days" event which actively brings together students and invited companies through technical presentations and discussions.

The EACOVIROE [6] project ([www.eacoviroe.org](http://www.eacoviroe.org)) (Erasmus Mundus Action 3 project) described under the heading "communication" brings together European companies and students through the creation of a field specific job and workplacement portal where students/graduates will be able to have direct access to a selection of relevant job offers and companies will be able to reach their future professional staff.

## Promotional action

Over the last few years, various discussions in different international settings (research collaborations, thematic networks, such as THEIERE and ELLIEC, and Erasmus Mundus consortia) pinpointed the growing need to enhance the attractiveness of Computer Vision and Robotics educational programs in Europe.

An Erasmus Mundus funded project was therefore launched, end 2008, and is supported by 14 European and 4 Asian partners offering know-how and experience in various fields of action.

The EACOVIROE (Enhance the Attractiveness of Computer Vision and Robotics in Europe) project, funded by the EU, focuses on the promotion of European master courses among Asian students and the quality assurance of all procedures related to incoming Asian students.

- A general MSc survey was performed in 2009 at the European level to identify Higher Education Institutions offering master programs in the field of Computer Vision and Robotics. Two data files of roughly 430 European MSc program contacts and International relations contacts were compiled. These European higher education institutions have been invited to upload their programs on the European Master portal for Computer Vision and Robotics that was specially developed for this purpose.
- A field specific European job portal is being developed and a company database is being compiled allowing job providers to upload their job offers and students to have direct access to relevant offers.
- Several actions in the field of international student hosting are foreseen such as a survey on quality assurance procedures, a seminar to report on the findings and a quality assurance handbook will consequently be elaborated. Two examples of student hosting have been prepared.
- All outputs (printed version/CD) will be presented at international conferences throughout the world and disseminated at international fairs. Asian countries involved are Brunei, China, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Thailand and Vietnam.

This partnership of European and Asian countries aims to contribute to communication on European MSc programs, enhancing attractiveness of Computer Vision and Robotics through its work packs.

## Conclusion

This paper has presented various European projects and their extension worldwide in the field of Computer Vision, Color and Robotics. Through these programs, the

authors highlighted different aspects: academic (credit exchange, international curricula), student hosting (housing, visa...), promotion of the programs (fairs, flyers, web site), management of international programs and sustainability through the involvement of private sector partners.



(non Erasmus Mundus)

## References

1. **VIBOT** (Erasmus Mundus Masters in VISION and ROBOTICS), two year English taught Erasmus Mundus Masters program [Online: [www.vibot.org](http://www.vibot.org)].
2. **CIMET** (Erasmus Mundus Masters in Color in Informatics and MEDIA Technology), two year English taught Erasmus Mundus Masters program [Online: <http://www.master-erasmusmundus-color.eu/>].
3. **EMARO** (European Master on advanced Robotics), two year English taught Erasmus Mundus Masters program [Online: <http://emaro.irccyn.ec-nantes.fr/>].
4. **MSc COMPUTER VISION**, two year English taught Masters program [Online: <http://www.u-bourgogne.fr/condorcet/msc-vision/>].
5. **VISOR** (PhD level program in VISION Optics and Robotics), Erasmus Mundus PhD program proposal submitted in April 2010 [Online: <http://visor.u-bourgogne.fr/>].
6. **EACOVIRE** (Enhance the Attractiveness of COmputer VISION and ROBOTICS in Europe), Erasmus Mundus communication project (2008–2011) [Online: [www.eacoviroe.org](http://www.eacoviroe.org)].

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This paper deals with three European Erasmus Mundus projects and focuses on Innovation in pedagogical way of teaching, Application of ICTs in Education, European Curricula, Industry and International partnerships in teaching. First, the EM Masters programs VIBOT, CIMET and EMARO are described, with partners from Spain, France, Scotland, Norway, Finland, Poland, Italy, Thailand Japan and China. These consortia also participate in the EACOVIRE project which closely links to industry and is presented in the second part. Finally are discussed the project extensions through industry days, a Doctorate program, double degrees with Asian countries, USA student exchange. A few perspectives conclude the paper. Ill. 1, bibl. 6, tabl. 2 (in English; abstracts in English, Russian and Lithuanian).

**Ф. Мериаудеау, Д. Фофи, А. Мериаудеау, Х. Адема-Лабиле, В. Торрес, А. Тремеау, Р. Зацкарна, В. Ресаз. Исследование влияния учебного процесса от Европы на изучения курса компьютерной графики // Электроника и электротехника. – Каунас: Технология, 2010. – № 6(102). – С. 15–18.**

Анализируются программы VIBOT, CIMET и EMARO, применяемые в учебном процессе Испании, Франции, Шотландии, Норвегии, Италии, Китая и других стран мира. На основе опытов разработан проект EACOVIRE и рекомендован использовать при подготовке докторантов. Ил. 1, библи. 6, табл. 2 (на английском языке; рефераты на английском, русском и литовском яз.).

**F. Meriaudeau, D. Fofi, A. Meriaudeau, H. Adema-Labille, V. Torres, A. Tremeau, R. Zaccaria, V. Resaz. Europos studijų programų įtaka kompiuterinės grafikos ir robotikos studijų programai // Elektronika ir elektrotechnika. – Kaunas: Technologija, 2010. – Nr. 6(102). – P. 15–18.**

Apžvelgiamos trys Europos Erasmus Mundus programos, naujais mokymo būdai, pramonės ir tarptautinės partnerystės mokymo strategija. Apžvelgtos VIBOT, CIMET ir EMARO studijų programos, naudojamos Ispanijoje, Prancūzijoje, Škotijoje, Norvegijoje, Suomijoje, Lenkijoje, Italijoje, Tailande, Japonijoje ir Kinijoje. Išanalizuotas EACOVIRE projektas, kuriame dalyvauja partneriai iš šių šalių. Apžvelgta mokymo strategijos įtaka doktorantūros ir dvipakopei Azijos šalių studijų programai. Il. 1, bibl. 6, lent. 2 (anglų kalba; santraukos anglų, rusų ir lietuvių k.).