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From Nowhere to Everywhere

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Abstract— This paper presents a synthetic view of a variety of projects built upon an Erasmus Mundus Master Course. It highlights double degree programs, European credits transfer, joint PhDs, research collaborations as well as few other related European projects going from Thematic Networks to another Erasmus Mundus Course.

Keywords—*Erasmus Mundus; double degree; Joint PhDs; Thematic Networks;*

I. INTRODUCTION

— Once upon time (2004), few young fellows (not that young anymore !) from France, Spain and Scotland decided to apply for an Erasmus Mundus Master Course (Money was already an issue then !) [1]. The coordinating institution was (and still is) in Le Creusot, France (city of 21 000 inhabitants - **Nowhere** !) on a campus having less than one thousand students. Almost ten years later, more than 300 students coming from more than 50 countries (**Everywhere** !) graduated and found a job within the next 3 months for more than 95% of them.

The master course called VIBOT [4] has been running since 2006 (re-selected in 2010), it is a two years program between le Creusot (France), Spain (Girona) and Scotland (Edinburgh). This master course was then duplicated to run in solo (courses fully taught in English) since 2010 in Le Creusot-France. Later on, 2013, this international offer was extended with a L3 taught in English as well and generated numerous double degree programs (**everywhere** !) with Universiti Teknologi Malaysia (Malaysia), Universiti Teknologi Petronas (Malaysia), Gunadarma Universitas (Indonesia), TEI Crete (Greece), Nanjing Tech University (as of 2017, China), and a double degree with Girona (Spain) under the EME call for two years between (2012 and 2014), VICOT [2]. This huge network, led to other actions such as an Erasmus Mundus Action 4 project EACOVIORE from 2008 to 2011 involving 14 European partners and 4 Asian partners (Japan, Thailand, Malaysia, Indonesia), participations in various European Project (Thematic Networks : Praxis, ELLEIEC, SALEIE), Intensive programs (ComVICS) and finally a new Erasmus Master Course MAIA [3] in 2016, run with the University of Girona as coordinator (UdG, Spain) and the Università degli studi di Cassino e del Lazio Meridionale (UNICLAM, Italy) , putting le Creusot (**Nowhere** !) as the only campus with Girona having two master Erasmus Mundus linked to the theme “*Computer Vision*.” The rest of the paper details all the above

facts and it is organized as follows: the second part will present the Erasmus Mundus master course VIBOT, it will then be followed by a part dedicated to a short presentation of the master Computer in Computer vision and Robotics that is the backbone of all joint degrees ; these are presented as subparts. The fourth part focuses on related European projects such as EACOVIORE and MAIA that resulted from the contacts and collaborations built while setting up and running VIBOT. This part also highlights some outputs in terms of Joint PhDs, joint publications and other European projects. The conclusion summarizes everything and synthesizes the enormous benefits obtained through these shared projects.

II. ERASMUS MUNDUS MSC VIBOT

A. A brief history

VIBOT (see Fig. 1) [4] (Masters in Computer Vision and Robotics) welcomed its first cohort of international students in September 2006 and graduated more than 250 students from 50 countries (see Fig. 2) since then. The courses and the multiple degrees were jointly delivered by the University of Burgundy (France, coordinating institution), Heriot-Watt University (Scotland) and Universitat de Girona (Spain). After an induction week held nearby the French Campus during which the students could fill their registrations for all three universities, meet the various partners and their classmates in a joyful environment, the entire cohort move to Scotland to start the first semester. The second semester was held in Scotland; for the third semester students were back in France. The last semester could be anywhere, as long as agreed by the coordinating institution and fulfilling the European Commission Conditions of the Erasmus Mundus Scholarship. After five successful years [5], the program was re-selected by the Education, Audiovisual and Culture Executive Agency (EACEA) for another period of 5 years with slight modifications of the curriculum and cohort movements (to ease visa procedures) that are presented after.



Fig 1. : VIBOT promotion 2013 and 2014.



Fig 2. : VIBOT Family.

B. Course Description of VIBOT II

The European master on Computer Vision and Robotics (VIBOT [4]) strives to meet the present need for quality control and automation of industrial processes. It also confronts the increasing importance of medical imagery in the field of health. The course aims to provide professional qualifications for robotics, computer vision, image processing and medical imaging either in public laboratories or private research companies. The two-year program (see Fig 2.) proposed is divided into four semesters: the first semester is spent at the University of Burgundy (France); the second semester takes place at Heriot-Watt University (United Kingdom); the third semester is hosted by the University of Girona (Spain), the fourth semester focuses on the master thesis carried out in a research lab or an enterprise involved in the consortium.

The VIBOT master as an extensive network of partners for students to do their internship; such as:

France: iCube, Laboratoire des sciences de l'ingénieur, de l'informatique et de l'imagerie, Université de Strasbourg, UMR CNRS 7357, ISIT (Institut des Sciences de l'Image pour les Techniques Interventionnelles, Université d'Auvergne, UMR CNRS 6284), LAAS(Laboratoire d'Analyse et d'Architecture des Systèmes, CNRS), LITIS (Laboratoire d'Informatique, du Traitement de l'Information et des Systèmes, Université de Rouen, EA 4108) , MIS (Modélisation, Information et Systèmes, Université de Picardie Jules Verne, EA 4290), Vecteo SAS (Le Creusot).

Semester 1: Université de Bourgogne (France)		Credits	
<i>All modules are mandatory</i>		ECTS ¹	SCQF ²
B31XA	Digital Signal Processing	5,5	11
B31XB	Introduction to Image Processing	5,5	11
B31XC	Sensors and Digitization	5,5	11
B31XD	Software Engineering	5,5	11
B31XE	Applied Mathematics	5,5	11
B31XF	Local Culture	2,5	5
Semester 2: Universitat de Girona (Spain)		Credits	
<i>All modules are mandatory</i>		ECTS ¹	SCQF ²
B31XG	Probabilistic Robotics	6	12
B31XH	Autonomous Robots	5	10
B31XI	Scene Segmentation and Interpretation	6	12
B31XJ	Visual Perception	6	12
B31XK	Medical Image Analys	5	10
B31XL	Local Culture	2	4
Semester 3: Heriot-Watt University (UK)		Credits	
<i>All modules are mandatory</i>		ECTS ¹	SCQF ²
B31XM	Advanced Image Analysis	7,5	15
B31XN	Multi-Sensor Fusion and Tracking	7,5	15
B31XO	Real-Time Imaging and Control	7,5	15
B31XP	Robotics Project	5	10
B31XQ	Local Culture	2,5	5
Semester 4: Full or Associated Partners		Credits	
<i>Mandatory</i>		ECTS ¹	SCQF ²
Research Training - MSc Thesis		30	60

Fig3. VIBOT II Course curricula

Italy: Università degli Studi di Udine

Luxembourg: SnT (Interdisciplinary Centre for Security, Reliability and Trust,) Université du Luxembourg, IEE SA, Contern

Spain: ADASENS, (Ficosa Group, Barcelona), CATEC (Centro Avanzado de Tecnologías Aeroespaciales, Sevilla), IRTA(Recerca i Tecnologia Agroalimentàries, Barcelona), PAL Robotics, Barcelona

Switzerland: EPFL (Ecole Polytechnique Fédérale de de Lausanne, Lausanne)

UK: SeeByte (Edinburgh), Toshiba Medical Visualization Systems(Edinburgh), Qooplar (Saffron Waldon, England)

Third-countries: e-Health (The Australian Research Center, Brisbane – Australia), RCV, KAIST (Advanced Institute of Science and Technology, South Korea), ORNL, (Oak Ridge National Laboratory, Tennessee, USA), iRobot, (Pasadena, USA), UTP (Universiti Teknologi Petronas, Malaysia)

The Master's qualification (consisting of a joint certificate, a multiple degree and a diploma supplement) is awarded by all three universities, and countersigned by the consortium's director. More information about the administrative aspects are given in [7].

III. MASTERS IN COMPUTER VISION AND DOUBLE DEGREES

A. Masters in Computer Vision

In September 2010, run in parallel with the VIBOT II (shared courses), was created the Master In Computer Vision and Robotics. This masters is identical, in term of course curricula, to the VIBOT II but runs only on the French campus and students get only awarded one degree from the University of Burgundy. However, thanks to the Erasmus Program and Credit Transfer, students have the opportunity to spend one or two semesters as visiting students to partners universities (Girona and Heriot-Watt); similarly, guest professors from partners universities are delivering courses on the French Campus, exposing students to the same course contents as the VIBOT students.

Semester 1: Université de Bourgogne (France)		Credits	
All modules are mandatory	ECTS ¹	SCQF ²	
B31XA Digital Signal Processing	5,5	11	
B31XB Introduction to Image Processing	5,5	11	
B31XC Sensors and Digitization	5,5	11	
B31XD Software Engineering	5,5	11	
B31XE Applied Mathematics	5,5	11	
B31XF Local Culture	2,5	5	
Semester 1: Université de Bourgogne (France)		Credits	
All modules are mandatory	ECTS ¹	SCQF ²	
B31XG Probabilistic Robotics	6	12	
B31XH Autonomous Robots	5	10	
B31XI Scene Segmentation and Interpretation	6	12	
B31XJ Visual Perception	6	12	
B31XK Medical Image Analys	5	10	
B31XL Local Culture	2	4	
Semester 1: Université de Bourgogne (France)		Credits	
All modules are mandatory	ECTS ¹	SCQF ²	
B31XM Advanced Image Analysis	7,5	15	
B31XN Multi-Sensor Fusion and Tracking	7,5	15	
B31XO Real-Time Imaging and Control	7,5	15	
B31XP Robotics Project	5	10	
B31XQ Local Culture	2,5	5	
Semester 4: Full or Associated Partners		Credits	
Mandatory	ECTS ¹	SCQF ²	
Research Training - MSc Thesis	30	60	

Fig 4. MSc Curricula

B. Double Degrees and Bachelor Degree

While establishing the Master In computer Vision and trying to lower down the running cost such as to be sustainable, different double degree programs were established across the world (**everywhere!**)

- A master degree with Universiti Teknologi PETRONAS in Malaysia, which ran from 2012 to 2015. Students were enrolled in both Universities and spent the first year in Malaysia and the second year in France. Students were awarded two degrees.

- A master degree with Universiti Teknologi Malaysia (UTM) in Malaysia [10]. This program offers candidates the opportunity to register at both Universiti Teknologi Malaysia (UTM), and University of Burgundy (UB), as students and have the opportunity to obtain a master degree from both universities having satisfied the requirement for awards from both universities.
- A double degree with Indonesia : The program is organized under the collaboration between Gunadarma University, Indonesia and University of Burgundy, France [11]. The collaboration agreement implies that the students of **SarMag** Program (in Indonesia) could study in France after they finish the undergraduate program. Students could get Dual-degree from University of Burgundy, France and Gunadarma University when they graduate from the two universities.
- More recently, two double degree programs were set up : one with TEI Crete [12] where the students spend the first year in Crete and the second one in France. The other one, approved in 2016, with Nanjing Tech University among only 8 labelled programs from the Chinese Government under this call. Students will be enrolled in a « 1+2 » scheme (one year in China and two years in France).
- To further increase the sustainability of the MSc, a L3 (last year of bachelor degree) was opened three years ago so as to attract good students holding a two years degree before entering the MSc. This program is accessible to undergraduate students who can justify of two years of study in a bachelor course (equivalent to 120 ECTS).

IV. RELATED EUROPEAN PROJECTS

The VIBOT and related programs offered a huge variety of networking opportunities and led to the participation into other european projects as well the coordination of one project under the Action 4 Erasmus Mundus program.

A. EACOVIROE

The EACOVIROE project (2008-2011) [13] was dotted with almost 300 k€ by the EACEA. It was coordinated by the University of Burgundy-France and its main objectives were to enhance the attractiveness of master programmes related to the fields of Computer Vision and Robotics in Europe for Asian Students. It was built on a large consortium comprising of 14 European partners :Rousse University- Bulgaria, Joensuu Yliopisto- Finland, Ecole Centrale de Nantes- France, Université Jean Monnet- France, CampusFrance- France, Fachhochschule Mainz- Germany, University of Iceland- Iceland, Università degli studi di Genova- Italy, Politechnika Warszawska- Poland, Universidade de Porto- Portugal, Universidad de Granada- Spain, Universitat de Girona- Spain, Heriot-Watt University- United Kingdom and four asian partners Universitas Gunadarma- Indonesia, Tokyo Science and Engineering Laboratory- Japan, University Technology Petronas- Malaysia and Asian Institute of Technology- Thailand. Various publications and presentations were

dedicated to the outputs of the project [5,7,8]. This work help in building double degrees as well as research collaborations among the consortium partners.

B. SALEIE

SALEIE (Strategic Alignment of Electrical and Information Engineering in European Higher Education Institutions) [14] was a thematic Network of 45 partners, running from 2012 to 2015. The project created a range of outcomes that benefit educational institutions, programme designers in the EIE area and demonstrate their applicability and added value across Europe.

C. ELLEIEC

ELLEIEC (Enhancing Lifelong Learning for the Electrical and Information Engineering Community) was a thematic network of 60 European partners coordinated by the Université Claude Bernard – France. The project ran from 2008 to 2011 [15].

Other projects were *PRAXIS*, another Thematic Network [16] and *IP Computer Vision and Intelligent Computer Systems (ComVICS)* (2012-2015) which was an IP projects that offered summer schools in the field of computer Vision for undergraduated students.

These intensive collaborations, also led to joint PhDs and joint publications with various partners of the consortium. One could highlight the strong collaboration with the Universiti Teknologi PETRONAS (3 joint PhDs gradutated, 4 currently enrolled, 15 joints publications) and Universitat de Girona (7 joints PhD, more than 30 joint publications). This strong and long lasting collaboration between University of Burgundy and the Universitat de Girona recently led to a new Erasmus Mundus Masters MaIA [3] that welcome its first promotion on september 2016. It is a two-year programme of study divided into four semesters designed and developed to ensure a clear and structured educational progress in the field of medical image analysis, fully integrated among the three universities of the consortium that are Universitat de Girona (coordinating Institution, Spain), University of Burgundy (France) and the Università degli studi di Cassino e del Lazio Meridionale (Italy). The first semester is held in France and overlaps with the MSc in computer Vision, the second semester is done in Italy while the third semester happens in Spain. The last semester is an internship that can be carried out in various institutions once approved by the coordinating body.

V. CONCLUSION

This paper summarizes more than ten years of intensive collaborative works between University of Burgundy ,European Universities as well as Third country partners in the field of computer Vision. It highlights the fact that through the original support of the EACEA and a tremendous amount of work, it is possible to shape up an international curricula (from **Nowhere**) and long lasting collaborations all over the world (**everywhere**). Collaborations that result on student exchanges, MOUs, multiple degrees, joint publications... and moreover a better understanding of the different systems and cultures and a strong friendship between the various partners.

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