COLLABORATION BETWEEN BORDEAUX-INP AND UTP, FROM RESEARCH TO EDUCATION, IN THE FIELD OF SIGNAL PROCESSING

Fernando Merchan, Héctor Poveda and Eric Grivel

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Towards a long-term collaboration

In research, not necessarily easy to launch new collaborations or to have long-term exchanges.

Millions of mobile students, but not necessarily easy to manage their mobilities.

How to encourage that research and teaching activities are mutually interactive?

Our purpose: sharing our positive experience to address these issues, through various aspects of the collaboration between Bordeaux and Panama
What did we do in the field of signal processing?

Towards a long-term collaboration involving several other actors
Who are we?
A collaboration between Bordeaux INP...

- Campus located in Talence (near Bordeaux, France).
- 3,400 students.
- A public institution with 5 internal schools and 3 partner schools.
- 19 engineering specializations including 5 through apprenticeship programmes in various fields:
  - cognitics, biology, food sciences, chemistry, physics, geological resources, environment, electronics, computer science, telecommunications, mathematics, mechanics and biotechnologies.
- Supported by 11 joint research laboratories, with University of Bordeaux, Bordeaux Montaigne University, Arts et Metiers Paris Tech, INRA and CNRS.
A collaboration between Bordeaux INP...
-more particularly ENSEIRB-MATMECA-

- 4 engineering specializations and 2 through apprenticeship programmes:
  - Electronics
  - Telecommunications
  - Computer sciences
  - Math. and Mecanics

- 1200 students.

- Supported by 5 joint research laboratories:
...and UTP -La Tecnológica-

- Main campus located in Panama City, Republic of Panama.
- 23,000 students.
- A public institution.
- 6 schools in different domains including:
  - Civil, electrical, mechanical, industrial, computer systems,
  - And food engineering.
- Supported by 6 research centers.
139 Degrees (Phd, Master, « Licenciaturas en Ingenierías », etc.)

26 « Licenciaturas en Ingenierías ».

65,000 graduate students.
What did we do in the field of signal processing?
Pillars of our collaborations

Research activities

Teaching activities

Research activities

including researcher mobilities

Double diploma

Student mobilities

through internships
Student mobilities
Student mobilities through internship

**Research activities / education**

- Internships of French students at UTP every summer in the field of signal processing
- Topics based on ongoing research projects and collaborations with research institutions in Panama
- Topics based on ongoing research projects and collaborations with research institutions and universities of other countries (Italy, Finland, etc.).
- Publications in journals and conferences
- Topics based on ongoing research projects involving industries.
Student mobilities through internship

1st example: noisy ARMA model identification based on an Errors-In-Variable approach with University of Bologna

Subject addressed by the interns:
- Time series parametric modeling (AR, MA, ARMA) and estimations of the parameters and the order,
- Denoising approaches,
- Error-in-variables approach (Frisch scheme): identification problem from noisy data.

The internship was a way to start the collaboration between Panama, University of Bologna and France. Since then, this is a collaborative work leading to one paper every year.
Student mobilities through internship

2nd example: manatee vocalization modeling, classification and clustering

with Smithsonian Tropical Research Institute

Methodology to count manatee populations by analyzing underwater recordings.
Premise: manatee individuals calls vary significantly.
Includes:
- Signal detection methods based on wavelets and Fourier.
- Denoising using signal subspace approaches
- Identification and counting: spectrogram PCA, signal dissimilarities (Jeffreys divergence) and clustering methods.
Student mobilities through internship

3rd example: Implementation of a prototype for interference characterization

with Aalto University and Ericsson (Finland)

Design of a low-cost, open-source, open-hardware prototype able to receive and analyze radio frequency signals in tunable frequency carriers and bandwidth

Research activities / education

SDR
Embedded computer
User interface
Double diploma
1st Double diploma between France and a country in Central America

Signed on December the 11th 2017 in the presence of the French ambassador
1st Double diploma between France and a country in Central America

From France to Panama

<table>
<thead>
<tr>
<th>Year</th>
<th>August – Dec.</th>
<th>Jan. – May</th>
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<tbody>
<tr>
<td>1st</td>
<td>SELECTIVE NATIONAL EXAMS</td>
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<tr>
<td>2nd</td>
<td>S5 - ENSEIRB</td>
<td>S6 - ENSEIRB</td>
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<td>3rd</td>
<td>S7 - ENSEIRB</td>
<td>S8 - ENSEIRB</td>
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<td>5th</td>
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<td>S9 –UTP</td>
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<td>6th</td>
<td>S10 - UTP</td>
<td>Stage (PFE)</td>
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Total duration: 6 years
1st Double diploma between France and a country in Central America

From Panama to France

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<thead>
<tr>
<th>Year</th>
<th>Mar. – Jul.</th>
<th>Août – Mai</th>
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<tbody>
<tr>
<td>1st Year</td>
<td>S1 – UTP</td>
<td>S2 – UTP</td>
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<td>2nd Year</td>
<td>S3 – UTP</td>
<td>S4 – UTP</td>
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Total duration: 6.5 years
Conclusions and perspectives
A Win-Win collaboration taking into account both research and education issues in the field of signal processing.

Way to collaborate promoted during workshops, organized by IFAC, with the French embassies of the countries in Central America (i.e. 7 countries: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama).

- Costa Rica on September the 26–27th 2016
- Guatemala on March the 13rd-14th 2018
Main difficulties: finding fundings

- ERAMUS + program to get more fundings

Organizing some events in Panama to promote the double diploma and attract new students to go to Bordeaux on order to prepare the double degree.

Opening to other topics: control (1 PhD starting on September 2019, nutrition, etc.).
Thank you for your attention