Techniques and Methodology of Innovation and Research in Informatics

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Presentation

- **Javier Larrosa** (larrosa@cs.upc.edu)
- www.cs.upc.edu/~ larrosa
- **Professor** in Computer Science (teaching since 1995)
- PhD in **Artificial Intelligence** (1998)
- **Research main topics:** Discrete Optimization (*Constraint Programming, Logic in CS, Graphical Models*)
- **Research Style:** Development of general purpose (?) algorithms driven by real world (?) application
- **Some figures:** 3 advised PhDs, around 50 scientific publications
- **Co-founder** of barcelogic.com (in 2010)
- **Visiting**: University of California at Irvine, Chinese University of Hong-Kong, Hanoi University of Science and Technology,...

Introduction

- This is not a **Research advertising** course
  - One of my goals is to expose you to the research world
  - There is a big ignorance about research and science
    - Que inventen ellos! (M. de Unamuno)
  - There is a big ignorance about what is (research on) Computer Science
    - Research = make cool apps
- However, I truly believe that Research is a very rewarding activity

Introduction

- This is not a **PhD advertising** course
  - *The Disposable Academic: why doing a PhD is often a waste of time* http://www.economist.com/node/17723223/print
    - *Slave labour*
    - Not enough job openings
    - Not salary premium over a Master
  - However, I truly believe that doing research is very rewarding as long as you have
    - friendly environment
    - right amount of pressure for success
    - true love for knowledge and creativity

Introduction

Goal

Help you understand the **research** and **innovation world** and the **skills** that you may need to do well there. We will give you some **hints** and show you some **tools** that can be useful if you want to be part of this world and you want your own research to have some **value**.

Introduction

A word of advise to Erasmus students

If you chose this course because it is not hard and will allow you enjoy the Barcelona experience, this is completely fine with me. Probably you made a good choice, but you still have to pass. This is the toll you have to pay.

- I think this is one of the most successful EU programs.
- I was myself (one of the first) Erasmus students back in 1992

Syllabous

- RESEARCH
  - Critical Thinking
  - History and Philosophy of Science
  - The Scientific Method
  - Types of research in Computer Science
  - Research Integrity and Ethics
- research
  - The Research Ecosystem
  - How to review, write and present a research paper
  - Information Competence (4+2 lectures given by library staff)
  - Data Analysis tools (2 lectures given by M.Paz Linares)
  - Latex (1 on-line lecture)

(upper case) RESEARCH

Zuckerberg

We need to celebrate and reward the people who cure diseases, expand our understanding of humanity and work to improve people's life.

Stephen Hawking

Science is not only a discipline of reason, but also one of romance and passion.

(lower case) research

I... NEED...
HEEEEEEEEELLLLP!

Introduction

Fact

We are very basic animals and rational only comes with a lot of effort.

- Our thinking is flawed and we cannot avoided.
- We are lazy, full of prejudices, and only want confirmation to our beliefs
- Learning how to do Research means taming your irrational side

Fact

The **Scientific Method** is a very primitive methodology to build knowledge and make technological progress, but it has been very successful during the last 400 years

Introduction

Fact

Research becomes obvious a posteriori

A quote from Bellman (dynamic programming)

> *What is worth noting about the foregoing development is that I should have seen the application of dynamic programming to control theory several years before. I should have, but I didn't. It is very well to start a lecture by saying, "Clearly, a control process can be regarded as a multistage decision process in which...", but it is a bit misleading. Scientific developments can always be made logical and rational with sufficient hindsight.* **It is amazing, however, how clouded the crystal ball looks beforehand**. *We all wear such intellectual blinders and make such inexplicable stupid mistakes that* **it is amazing that any progress is made at all**.

Also *zero* and *numbers for measuring*

Introduction

- **Research Skills** are important for both academia and industry (mainly innovation)
- Difficult (if not impossible) to teach and to learn
- Here we will give you some exposure to research issues
- ... and I will give you some (common sense) hints and advice
- ... and we will see some useful tools

Introduction

Fact

Traditionally, researchers learn how to do research by doing, by being supervised and evaluated.

- ... and always with tight time constraints
- ... and always in need of short-term results
- Little opportunity for reflection

Same thing applies to innovators (must satisfy investors in terms of revenues,...)

Introduction

Fact

The research world is full of jargon and conventional wisdom

- Jargon: Survey, Workshop, rebuttal, program committee, conference chair, editor-in-chief, doctoral program, satellite conference,...
- Wisdom: contribution, relevance, impact,...
- Young researchers often think *Why nobody told me?*

Research/Innovation in Computer Science

Fact

Research in Computer Science can come in very diverse forms

- Theoretical (like in Mathematics)
- Empirical (like in Natural Science)
- Action Research (like in Psicology, Education,...)
- Artifact building (like in Engineering)

Evaluation

- Information Competence (20%)
- Writing test (30%)
- Essay on Ethics (20%)

Each of you must choose a **research paper** from the proceedings of a conference on **Computer Science**.

- Review your selected paper (10%)
- Presenting your selected paper (20%)

Note: Deadlines and exam dates will be announced in due time. If you have a conflict, it is your problem (default).

Evaluation

This course is also about **judging critically**, so I will use **peer assessment** in:

- Essay on Ethics (20%)
- Review your selected paper (10%)

So each submission (essay/review) will be evaluated and graded by three of you. Your grade will be:

- The average of the three marks
- My adjustment based on my own opinion of your submission (+-30%)
- My adjustment based on how well you evaluated your peers (+-30%)

Your own grade may be adjusted depending on how well you evaluate and grade your peers.

Evaluation

Because grading in this course is highly subjective some of you may disagree with your grade. Be aware that:

- You have the right of having some clarification
- You do not have the right of discussing the grade until agreement

My Evaluation Golden Standards for this course:

- Excellent 9-10
- Average 7-8
- Acceptable 5-6
- Unacceptable <5