What is scientific research?

- Research is a systematic inquiry to describe, explain, predict, and control the observed phenomenon.
- Basic research: *to understand and explain the phenomenon, leading to theory and knowledge.*
- Applied research: *to pursue potential solutions to human/social problems, to better control our environment.*
- One important point: the heart of the research is not about statistics/observations/results, but the thinking and discovery of the underlying principles/arguments behind these observations.
- *The relations and difference between Research and Technology, or Science and Technology?*

Process of scientific research

- Identify a research problem/question
- Prepare your research project: *literature survey, potential methods/designs, data collection if necessary …*
- Conduct your main research study
- Deliver research outputs: *reports, papers, publications, thesis …*

Identifying your research problem/question/topic

- Key issues when thinking about a research topic
  - Answerability, *e.g., whether you may get the data necessary for conducting your research*
  - Significance, *whether the topic is worthy of your investment of time and effort*
  - Relevance of interest and passion
  - …

Seems finding a research topic is a purely logical activity conducted inside one's mind.

Identifying your research problem/question/topic

- Topics picked in practice
  - Given by supervisors
  - Based on your personal life experience
  - By curiosity
  - By chance
  - …
- It is always challenging to develop a workable, interesting, and significant research topic

Identifying your research problem/question/topic

- A few typical challenges
  - Inadequate training
  - Unavailability of relevant data
  - Too soon deadline to submit/start your research proposal
  - Too broad of your research designs
  - Sticking to big theory and resisting to data analysis

Identifying your research problem/question/topic

- Good practices
  - Making good use of the existing literature
  - Trying to narrow down your problem, *e.g., to make it as an intellectual puzzle*
  - Finding emergent topics from feedback loops
  - Persuading others with your ideas of research plans
  - Thinking of long-time topics and short-term topics
  - …
  - Originality

Doing "original" research

- What counts as "originality"?
  - From dictionary, it may mean being *novel, creative, independent in invention, or imaginative …*
- Can a fresh Ph.D. achieve this?
  - Ph.D. research is less likely to involve a shift of paradigm in your field. Instead, knowing how research is normally done in your field is a good evidence of your Ph.D. study.
- Being a professional, independent researcher

Viewing originality as independent critical thought

- A few strategies to claim originality
  - Making a ***meaningful*** extension/bridging of current ideas
  - Providing a fresh perspective/analysis or a new insight in an established area
  - Defining new problems/applications *(in engineering areas)*
- Originality is more about persuading colleagues than about what is objectively discovered.

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Making your mark!