How to Do Research

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What is research?

• Investigate and understand the known unknowns and unknown unknowns in the scientific world.

• In our lab, we are specifically interested in:

  • designing accurate, robust, and scalable **machine learning** algorithms;
  
  • advancing **natural language processing** models;
  
  • combining **learning and reasoning** for better AI.
How’s research different from taking courses?

• Taking courses: instructor tells you exactly what to do.

• Research:
  • define an open research problem with your advisor;
  • you (students) take the initiatives;
  • discuss and refine the technical approaches;
  • you (students) implement the approach and perform experiments to verify the idea.
How to make good progress in research activities

• Clearly define the problem / task that you want to solve;

• Understand the literature: what other people have done, and what you can learn from them;

• Work out the algorithm first, find a suitable dataset, and put theories into practice: write some code;

• Start with smaller subset of data for debugging, and move on to larger datasets.

• Document the results carefully in spreadsheet / docs.
How to measure the effectiveness of ideas?

• Use **mathematical** tools to clearly define the problem and your solutions;

• Look at the theoretical properties of your **algorithms**;

• Define good **metric(s)**, and perform experiments on **multiple datasets**;

• Report results and compare with state-of-the-arts **baselines**.
Why is publication important?

• Publication is the most important formal method for scholarly communications.

• Presenting your research and attending leading conferences will create impacts, get inspirations, and facilitate the exchange of thoughts and good ideas.

• Peer-review is a good way to get feedback from top researchers in your field.

• And it is a relatively objective way to claim the effectiveness of your research.
What is in a good research (paper)?

• Is the problem new?

• Is your approach new?

• How good are the results comparing to prior work?

• Can you contribute any new open-source datasets/code?

• Is this paper well-structured and well-written?
Research is hard

• They are open problems that no one has a perfect solution!

• Implementing ideas and debugging code could be challenging.

• Performing good experiments are not easy.

• Writing papers against deadlines..
Research is rewarding

• You helped to advance science!

• When your first top conference full paper is accepted… (acceptance rates typically 10-30%);

• Other people attend your talk, read/cite your papers, and use your code/approaches;

• You are now the world’s expert in this area.