Thoughts on Research

Disclaimer: Research is a very personal endeavor and there is no 'right' way to do it

Research Project Lifecycle

- Idea strikes you, one of 3 things happens (or you join existing project!)
  - Oh no, someone has done the exact same thing, pivot!
  - Way too broad
  - Way to narrow
- Scope for time and effort
  - Very hard *a priori,* usually happens when you actually try to work on the idea

While paper!=READY:

- Results and Analysis Phase
  - 'Scientist-in-the-sky' time, platonic ideal of 'doing research'
- Write, edit, write
  - We don't get trained for this

Project Start: You're leading

- Sanity check the idea with as many people as possible
  - Hallway conversations, quick zoom meetings
  - It can be uncomfortable and potentially discouraging, but helps quick refinement
- **Set up a project management tool**
  - Document ideas and progress
  - Commit code early and often
- Try to work out a high-level pitch
  - Why are you working on this?
  - Who will care?
  - Why do you enjoy it?

Project Start: You're joining

- Learn as much as possible about the project!
  - Read existing documentation and previous work
  - Don't think of yourself as just doing chores on it
  - Interrogate the premises of the project
- Being a good collaborator
  - Try to share new directions for the project
  - **Coding**: can you help standardize the codebase?
  - **Experiments**: Are there missing components wrt datasets, models, setups?
  - **Analysis**: Summarizing and interpreting results from (somewhat) of an outsider's perspective

Scoping a project

- Too vague
  - 'I will use ML to detect anomalies'
- Too specific
  - 'I will use Isolation Forests to detect the addition of a new device to a 4 device topology using network flows'
- Too ambitious
  - 'I will develop a new general-purpose algorithm to analyze different types of streaming network data at enterprise scale'
- Too unambitious
  - 'I will implement an existing algorithm to analyze streaming network data on a local setup'

Results and Analysis

- Why are you doing the current experiment?
  - Have a clear hypothesis
  - If it succeeds, is there a more challenging setting you should try?
  - If it fails, why and what next?
- Reproducibility
  - Save experiment conditions!
  - Have scripts to recreate results
  - Repeat experiment multiple times
- Interpreting results
  - Don't assume results support your agenda

Write, edit, write

- Writing
  - Don't edit during writing
  - Put down a structure for each section, i.e. what function is served by each paragraph?
  - Keep the overall story of the paper in mind, remind readers frequently *why* they need to read this
  - Disconnect from the internet
- Editing
  - **Self**: Edit the next day, interrogate each sentence for intent and redundancy
  - **Others**: Be gentle and constructive, don't focus on grammar in first few passes, focus on preserving intent (if possible) while shrinking/expanding
  - **Practical**: use colored text when suggesting alternatives, retain edit history