CS4040: Projects and Latex

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Content

- **Dissertation project**
- CS4040 project
- Latex

Types of Project

- *Prototype*: Develop a new system, see if it is useful
- *Improvement*: Develop better alg/sys, compare to existing alg/sys
- *Exploration*: Test hypothesis about behaviour of systems
- *Other*: Mathematical proofs, meta analyses, observation, …

Prototype

- Develop an app (website, etc) that does something useful
  - » Ideally for real-world users
  - » Expect requirements analysis and evaluation with real users
  - » Expect good software-engineering
- Example: develop a tool to give feedback to new mothers about their baby, based on data about sleep, diet

Prototype

- Prototype because needs more dev work and support to be useful
  - » Documentation, training material
  - » Help desk and bug fixes
  - » Port to different platforms and browsers
  - » Etc
- So build prototype in thesis project
  - » Don’t worry about other stuff

Improvement

- Propose better algorithm or system for some problem or task
  - » Can be theoretical or practical
  - » Expect experimental comparison to current state-of-the-art
- Example: Develop better technique for creating believable body language in some computer game contexts.

Improvement

- Typically focus on specific niche or context.
  - » Body language during certain types of dialogues, not body language in general
- Evaluate using people, timings, or simulations

Exploration

- Test a computer science hypothesis
  - » Sometimes theoretical
  - » Sometimes based on published research paper
- Example: evaluate how much ChatGPT actually helps software developers
  - » Productivity gain from using ChatGPT

Exploration

- Need to show you have been careful and rigorous in implementation and experimentation
- Evaluate by comparing to published findings

Its your project!

- Supervisors propose topic
  - » You can also propose your own topic
- Usually you can refine project based on your preferences and goals

Doing Project

- Project plan
- Literature review
- Develop algorithm/system
- Evaluate algorithm/system
- Write dissertation

Doing Project

- Often good to break up into core and extensions
  - » Core: stuff you know you can get done in time available
  - » Extensions: extra stuff (experiments as well as dev work) if time permits
- Don’t do something very ambitious and run out of time

Thesis

- *Introduction*: Context of your study, with initial hypothesis, aims and objectives.
- *Literature Review*: Critical review of existing work
- *Method / Experimental Setup*: What experiments did you run, or what models did you build? Why?
- *Results*: What did you find? Use statistical analysis where possible
- *Discussion*: Critical analysis of your findings, and how they relate to hypothesis/aims/goals.
- *Conclusion*: Summary of project and findings. Lessons learnt, future work.

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CS4040 Project

- Expect experimental evaluation of existing system or algorithm
  - » You already know how to write code
  - » So focus here is on creating and testing hypotheses
- Open to other projects which test CS hypotheses
- Building a prototype **not** acceptable

CS4040 Project

- Must be different from dissertation!
- Cannot use the CS4040 project to start working on dissertation
- OK for CS4040 project in same area
  - » working on it teaches you about relevant technologies, research lit, etc

Typical Projects

- Compare recommendation algorithms
- Measure speed impact of caching
- Compare speed of crypto algorithms
- Compare vulnerability of password schemes to cracking tools
- Implement a machine learning algorithms for a specific application

Research Proposal

- Choose topic and research question
- Read related work
- Create specific testable hypotheses
- Design experiment (*high level*)
- Conduct experiment
- Analyse results of experiment
- Formulate key insights and conclusions
- Write report

Full Project

- Choose topic and research question
- Read related work
- Create specific testable hypotheses
- Design experiment (*detailed)*
- Conduct experiment
- Analyse results of experiment
- Formulate key insights and conclusions
- Write report

Project

- Focus is on research questions and hypotheses, experimental design, analysis of results, writing
- Not on coding!!!

Topic

- Prof Reiter must approve topic
  - » Send me an email
- Suggest one sooner rather than later

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Latex

- Markup language for creating docs
  - » Vaguely like HTML
  - » HTML: xx.html displayed by Chrome
  - » Latex: xx.tex turned into PDF by Latex
- Write Latex markups directly or use IDE
- Run Latex to see results
- Also support for bibliographic reference, formulas, table of contents

Latex vs Word

- In most scientific fields, research papers are written in MS Word (Google doc, etc)
- However CS papers usually in Latex
- Theory: Latex better than Word for authors who can write code
  - » Make writing more like coding
  - » Not everyone agrees…

Usage of Latex

- Use Latex for both CS4040 and dissertation project
  - » For CS4040, there are instructions and style files in MyAberdeen

Running Latex

- Cloud: Overleaf (recommended)
  - » https://www.overleaf.com/
  - » No setup hassle
  - » Use in practical on Thurs
- Locally on PC: Miktex/Texworks is free
  - » https://miktex.org/
  - » Can be complex to set up

Overleaf Latex intro

- https://v2.overleaf.com/learn/Learn_LaTeX_in_30_minutes
- https://www.overleaf.com/learn/latex/Bibliography_management_in_LaTeX
- Lots of other great tutorials

Latex advice

- Use Overleaf
  - » Work through relevant tutorials
- Upload CS4040 template project (MyAberdeen, Resources) to Overleaf
  - » Overleaf New Project, Upload
- Use Google Scholar (etc) for bib entry
  - » Search on title, click Cite, Bibtex; copy into Latex bib file

CS4040 report

- Source, output