AI MASTER CLASS
Anders Kofod-Petersen
Professor, Department of Computer and Information Science, NTNU
Director, The Alexandra Institute, Denmark
DART AND LABS
DATA AND ARTIFICIAL INTELLIGENCE GROUP

- People
  - 19 faculty, 3 post doc, 18 PhD, 3 adjoint positions, 4 emeritus
- Labs
  - Big Data Lab
  - Norwegian Open AI lab
  - Gemini Big Data Centre
- SFI/SUF centres
  - Centre for exposed aquaculture operations
  - Centre for scalable data access in the oil and gas domain
  - Centre of excellence in AI (starting up)
MOTIVATION – WHY WORKING WITH THE AI-LAB

- Access to **relevant projects** – both **basic** and **applied**
- To allow **wide variety of areas and problems**
- **Cross-disciplinary** projects

lab-affiliated events
access to real-world problems and datasets
research collaboration
state-of-the-art infrastructure
documents and masters' education
cloud-scale experiments
lab-scale experiments
AI MASTER
CLASS
OVERVIEW OF MASTER CLASS

- 09/09 – Welcome to DART / Research Questions
- 23/09 – Literature review / reading and writing papers
- 14/10 – Writing a thesis / HPC at NTNU (*)
- 04/11 – Quantitative empirical research (*) / Reproducibility

(*)& Subject to change of date
THE THESIS

- You might save the planet. If you don’t know *how* and *why*, and can’t describe it, you won’t get a good grade!
- The average student can reproduce knowledge
- The above average student can add to knowledge
- The good student can reflect on the addition

- All of this is in your thesis!
METHOD IS OUR FRIEND
RESEARCH QUESTIONS
TODAY

- Research questions
  - How
  - What
  - Why
- How to evaluated your work
RESEARCH QUESTIONS

‣ These are the questions that your work should answer
‣ These are the questions you are evaluated on
‣ There are the questions your thesis answer
‣ There are the questions that guide your choice of methods
‣ They guide your choice of evaluation method, which guides your choice of research questions
RESEARCH QUESTIONS

‣ How to chose you research question
  ‣ There is a very difficult(*) and interesting(**) problem that needs to be solved
  ‣ There is a very interesting(*) and promising(**) method that could be applied on an existing problem
  ‣ There are some flaws or issues with an existing method
  ‣ Research questions are all pointing towards the same goal
WHAT IS YOUR GOAL?
WHAT ARE YOUR RESEARCH QUESTIONS?
GOING FORWARD
**FIRST QUESTION...**

- … is always: "have anybody been doing this before?"
- The answer is (almost) always yes!

- How to evaluate?
METHOD IS OUR FRIEND

- In this case we can approach figuring out who did what, and how in a systematic manner
- Stay tuned for September 23.
SECOND QUESTION...

- … is always: "what is my contribution?"
- This is not formally a research question

- How to evaluate?
THIRD QUESTION...AND BEYOND
EXAMPLE (FROM SINGLE-OBJECTIVE TO MULTI-OBJECTIVE)

- **Goal** Create a multi-objective metaheuristic algorithm based on a single-objective algorithm from the literature.
- **RQ1** Which single-objective algorithm has the best potential for multi-objective extension?
- **RQ2** Which multi-objective techniques are most suitable for extending the selected algorithm to multi-objective?
- **RQ3** How does the proposed algorithm’s performance compare to other competitive algorithms from the literature?
EXAMPLE (TELENOR WATCHDOG)

• **Goal** Create an application that increase users ability to maintain privacy on an Android device by informing about actual and possible threats for disclosure of sensitive information.

• **RQ1** Which techniques can be used to detect possible malicious behaviour of third-party applications based on real-time system monitoring and application analysis on an unrooted Android device?

• **RQ2** What is the best way to inform users about threats in installed third-party applications on an Android device and provide them with incentives to uninstall these applications?

• **RQ3** Which user interaction patterns can be employed to make users aware of their privacy-related behavior?
EXAMPLE (SLIDING DOORS)

• **Goal 1** Design a model of features, human behaviour and intentions.

• **Goal 2** Design a mechanism for capturing and extracting features according to the model.

• **Goal 3** Design a reasoning mechanism for inference of intention.

• **Goal 4** Implement software comprising the results from Goal 1, 2 and 3. Develop a complete software application for the operation of a door equipped with sensors giving it the ability to reason.

• **Goal 5** Build a motorized sliding door

• **RQ 1** What set of computer vision algorithms will meet Goal 2 efficiently?

• **RQ 2** What is a well suited reasoning mechanism for this task?
EXAMPLE (THE FAIRY TALES OF THE ANT PRINCESSES)

- **Goal1** Increase the number of public transportation passengers by making urban transit networks more efficient

- **RQ1** What is the state-of-the-art in solving vehicle routing problems using swarm intelligence methods?

- **RQ2** How does the proposed algorithm’s computational results compare to results published in the literature?

- **RQ3** What are the potential advantages and disadvantages of using a graph database in our implementation?
WHAT’S YOUR POISON?