Lessons in sales and on the interface between OR and industrial machine learning applications

D.Sc., Anton von Schantz, 15.5.2023

My background

- First time working on machine learning tasks in 2009 for the Helsinki City Rescue Department.
- I earned my PhD from Aalto University's Department of Mathematics and Systems Analysis. My thesis topic was crowd evacuation modeling. Supercomputing, mathematical optimization, multi-agent systems, and application development were involved.
- As of summer 2021, I have been working as a fulltime solopreneur/freelance consultant (first freelance project already in Fall 2020).
- Clients so far: YIT, Alma Media (Nettiauto and Nettimoto), Posti, Barona, SYKE (Finnish Environment Institute), a Nordic Bank (my longest contract so far)
- Currently, I am automating the core business process of a bank using machine learning, and also building their machine learning operations capability. My side project is building a machine vision system for SYKE.

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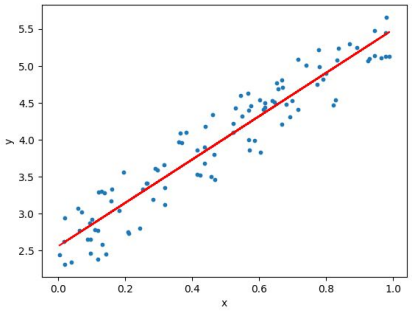
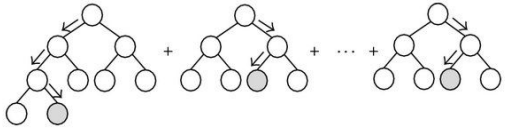
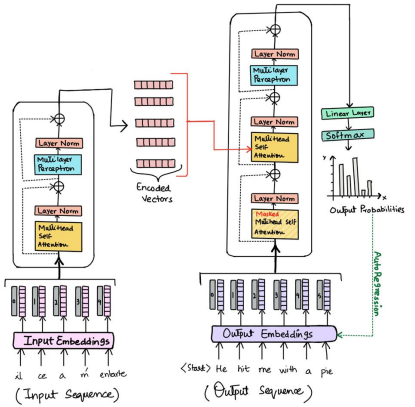
Interface between OR and industrial machine learning (ML) applications

Machine learning models are built using optimization algorithms

- As operations researchers we are well-versed with optimization problems
- Machine learning is essentially a problem of optimally fitting a function to a dataset
- Everybody in the field needs to constantly learn concepts, and our background in OR helps us quickly learn these new concepts

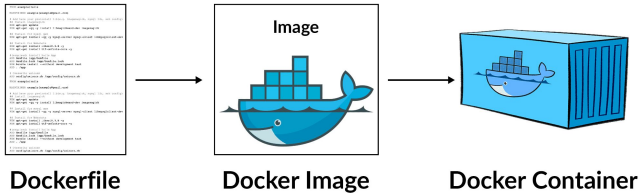






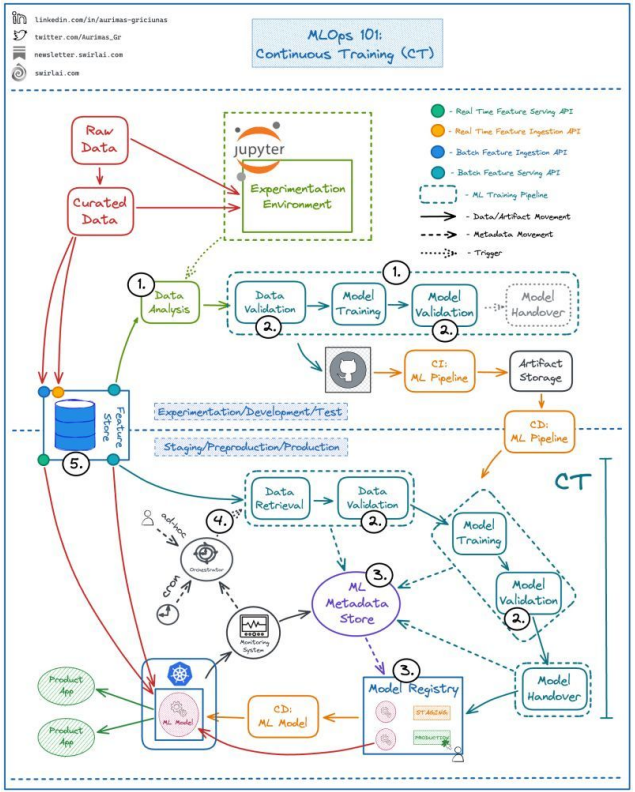
Programming

- Coding is a must if you want to be an ML engineer. After all, machine learning is by definition *the use and development of **computer systems** that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyse and draw inferences from patterns in data*
- You can get away with less coding if you choose management track, but still good to understand it on a high level
- Practice as much as you can during your PhD
  - Use Python instead of Matlab/R/whatever
  - Run computations on Aalto or CSC Supercomputers, or even better, using Cloud services
  - Create reproducible code. Use Python virtual environments and Docker containers
  - Use version control. Push your code to Github
- Publish your research code. Even better, create a webapp, where people can interact with your models



Setting up ML production systems requires systems thinking

- Ideally your ML model will be part of a production system ⇒ it will be used to automate some important function
- This is where something called Machine Learning Operations (MLOps) becomes important
- MLOps is an ML engineering culture and practice that aims at unifying ML system development and ML system operation. Practicing MLOps means that you advocate for automation and monitoring at all steps of ML system construction, including integration, testing, releasing, deployment and infrastructure management
- In addition to programming skills, being able to think in terms of systems is important, i.e., systems thinking, understanding feedback loops and system dynamics.

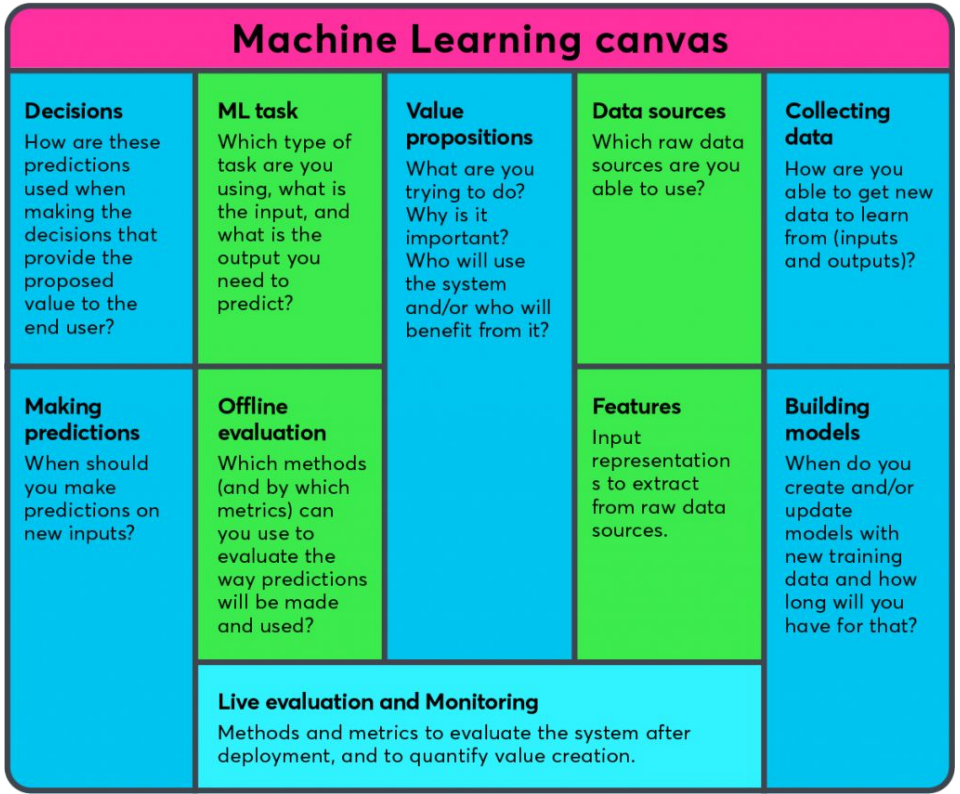


Finding a problem with knowledge impact vs. business impact

- In academia, we are used to choosing research problems that have “knowledge impact”
- In industry, you just have to switch to choosing research problems that have business impact
- This is a skill required both for employees, for consultants selling inside a company and freelancers trying to find new clients
- Think of this as receiving funding for the work you do

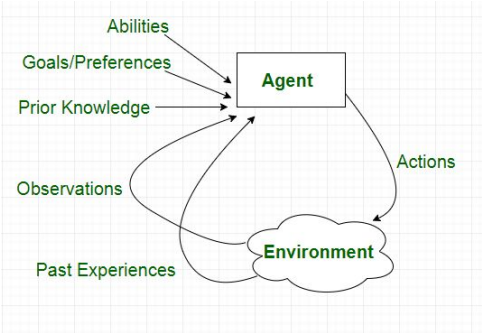
Formulating a problem from business requirements

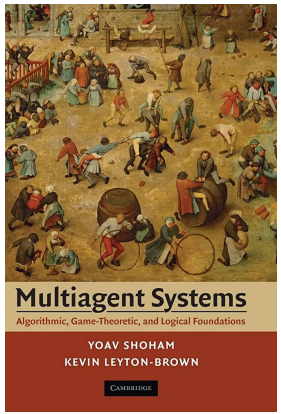
- After you found a problem, how to think about it in a more structured way?
- Requires a modeling mindset, which is an OR PhD strong suit
  - We have experience in modeling complex real-life phenomena
  - We have knowledge of a wide variety of modeling frameworks
- Requires also communication with domain experts/clients
  - Teaching and giving conference presentations prepares in both active listening and communicating your ideas



What next? Maybe industrial applications of ML agents?

- We have somewhat of a research tradition also surrounding agents and multi-agent systems at SAL
- Currently most ML applications are confined to purely informational or inferential tasks such as classification or prediction
- What if we would give agency to the ML model?
- For example customer Chatbots or agents that write code
- Look into Python libraries like Langchain and Transformer Agent object
- This is also territory, where AI risks start to kick in…





Course book in me and prof. Ehtamo's SAL course

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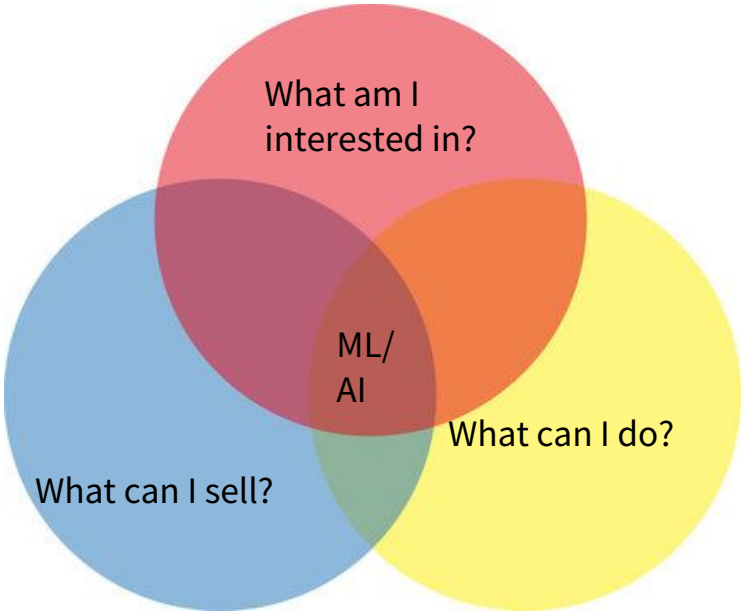
Lessons in sales

Different paths

- Why to be a solopreneur
  - Freedom
  - Possibility for higher income
  - Machine learning work

Figure out your service/product



Practical matters of becoming an entrepreneur

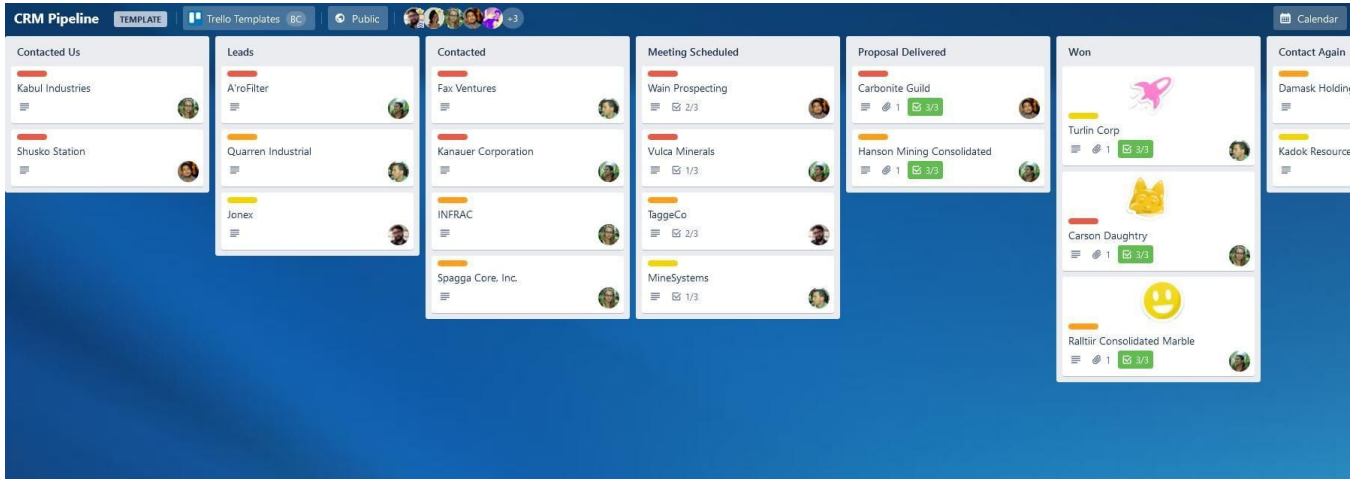
- Very little paperwork actually involved, you can become a sole proprietor (“toiminimi”) in 15 minutes at the website https://www.ytj.fi/
- If estimated income is > 50,000€/year a limited liability company is better (“osakeyhtiö). This takes also about 15 minutes at the website https://www.ytj.fi/
- You have to pay YEL (=pension). Minimum about 120€/month. You can set the amount yourself.
- Get an account for your company, I recommend Holvi (https://www.holvi.com/) . It is cheaper and easier to setup then a company account in a regular bank.
- When you start an OY, hire also an accountant. I use Lemontree (https://lemontree.fi/), about 100€/month.

Closing sales is the only thing that matters

- Especially when you start out, you should not worry about company website, logo, branding, mission statement, office, hiring people…Even the practical matters on the previous slide are irrelevant.
- The only thing that matters is getting actual customers and cashflow, so that you can sustain yourself.
- My advice is that you should not be that picky in the beginning. With more money and experience, you have more saying in what work and how you do it.
- In fact with more money, you can outsource, hire and take on more risky research&development projects

My sales process in the beginning

- You should not celebrate before an actual deal has been signed.
- Better to have multiple deals that you are about to close, then just hoping one will succeed
    - You will appear more confident if you have multiple options (getting clients is not just about your math/techical skills), but how you are perceived
    - You will not fall into desperation if things don't immediately work out
- Utilize a paper sheet, excel or a tool like Trello to keep track of your "sales pipeline", i.e., customers contacted, customers re-contacted, initial meeting booked, second meeting booked, deal closed.



Where to get potential clients or “leads”

- There are agencies, strategic partnerships, freelance ecosystems that you can join. You should join all of them. They will either try to sell you or there will be 3-12 month 25-100% allocation projects you can try to apply for.
  - Some agencies in Finland: Witted, Finitec, Siili One,...
  - In the Nordics: Tingent
  - International agencies: 7N, Toptal, A team
- Online messageboards
  - Hackernews “freelance for hire” thread
  - Linkedin message groups
  - Facebook message groups
  - Discord groups
- Find people in companies in positions to make hiring decisions and Linkedin message/call them
- Go to tech and business events and chat people up
- Freelance platforms like Fiverr or Upwork
  - I’m not a big fan of these, you are competing with every around the world and pay can be very small
- Apply to job postings, and try to take on the position by making a freelance deal

Getting an agency client

- Companies want to know that you are to be trusted with some business-critical system
  - You have to in one way or another give that impression
- This can be very hard in the beginning, even for more senior workers
- CV and cover letter should be as polished as possible
- Don’t undersell yourself, but be prepared to do more learning on the job, if you oversell.
- Gather references and testimonials from previous work and client.

Closing the deal

- If you got a deal through an agency, things are easy. They are going to provide you with agreements to sign. You are usually just a hired expert, so work can feel like temporary job.
- If you got a deal through some other means, there are things to consider:
  - Deciding on deliverables/milestones
    - Very rarely someone trusts you from the get go
    - Delivering small milestones increases trust
  - Set up frequent meetings
    - Making sure that you are doing what the client actually needs.
    - Also making sure you do not do any unnecessary work
  - Negotiate the pay. Hourly or per milestone?
  - Make an agreement all parties sign

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Thank you!

Any comments?