Welcome to IN-STK 5000/9000

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UNIVERSITETET
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About Dirk

- Associate Professor at UiO since 2018.
- Background in computational physics.
- Vice President Marketing and Supply @ Equinor
  - IT solutions for commodity trading (incl. algo-trading) and distribution.
- Experience from consulting and a start-up.
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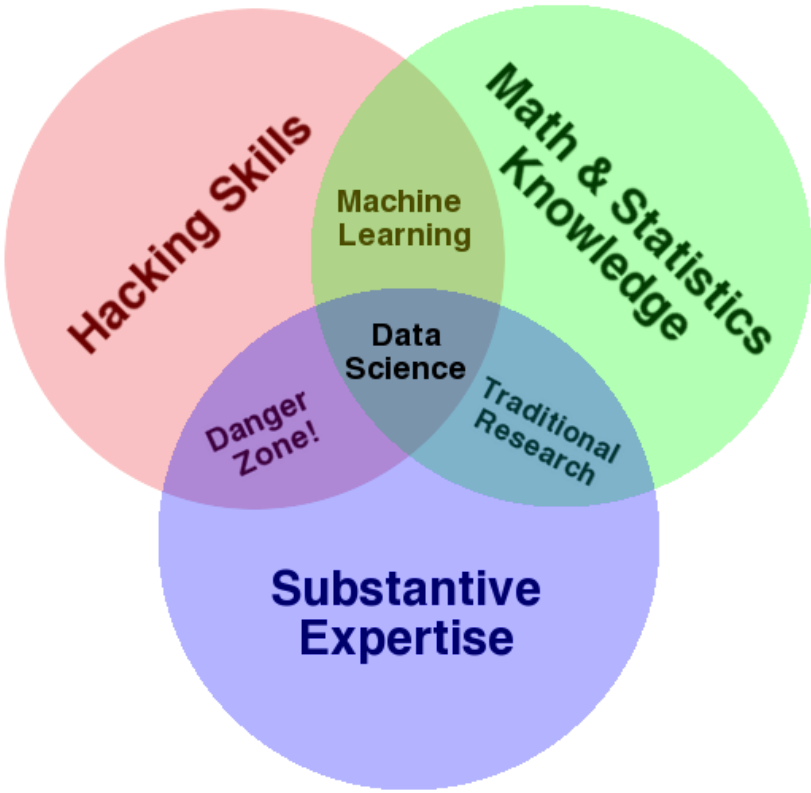
What this course is about

- Data Science includes
  - Statistics
  - Computer Science
  - Business Understanding

This course deals with the **interfaces of and overlaps** between computer science, statistics, and business (decision making) concepts. How does one, using statistical methods and CS concepts, take sound business decisions?

We will also work on communication and presentation.



The Importance of Presentation Skills

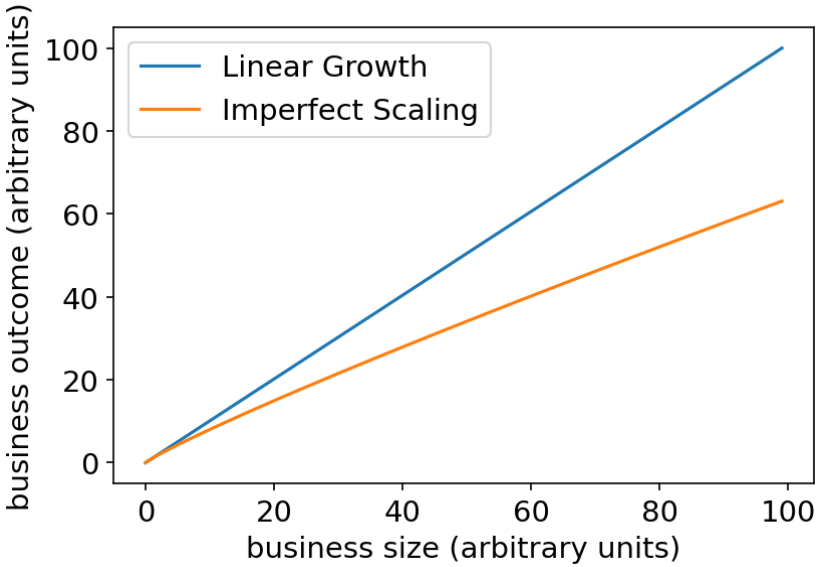
- Data Science is by definition a multidisciplinary activity
- Key to your success will be to communicate difficult concepts clearly to people with diverse backgrounds

Trust in AI

- Lack of trust in machine learning methods stands in the way of broad adoption
- Good communication skills help you to build trust
- Some of the methods discussed in the lectures address this
  - Fairness
  - Privacy
  - Reproducibility
  - Explainability

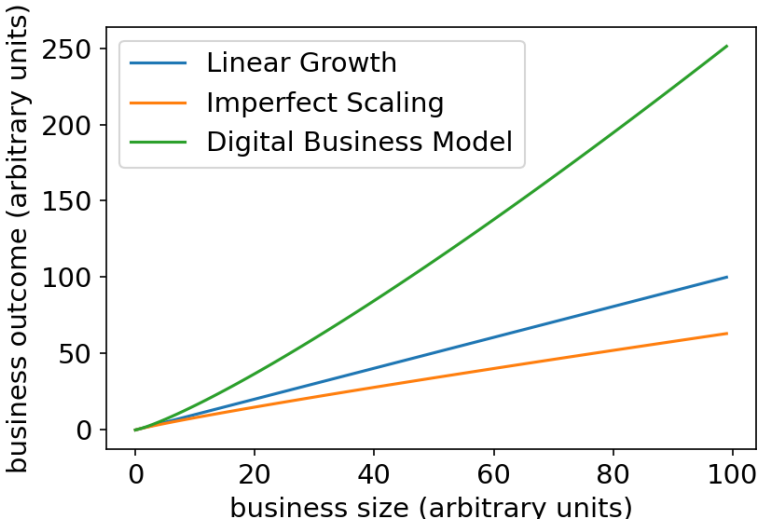
Why Data-Driven Decision Making?

- In traditional business models humans take most decisions
- This doesn't *scale* well
  - Making more decisions takes more employees, and costs more
    - E.g. selling more loans
    - Shipping more products
- Business outcomes scale linearly in classical business models
  - Often even worse-than-linear due to inefficiencies at scale



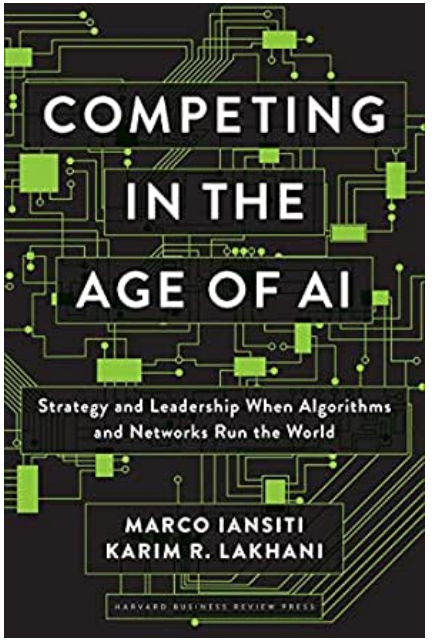
Digital Business Models

- In digital businesses, processes are highly automated
- Digital agents can be duplicated at almost zero marginal cost
- Decisions get better the more *data* is available
- Thus, business outcomes scale *much* better than linearly.
  - Ref. also *network* effects



Side Remark: Network Effects

- Digital Businesses perform better the more *data* they have
  - More data leads to better models, which lead to better decisions
- This generates positively reinforcing dynamics
  - The more customers, the better the customer experience
    - The better the customer experience, the more customers
- Social networks obey a similar dynamic
  - The more users are on in the more attractive they become



A Few Words on Business Understanding

- Understanding the aim of automating decision making is *context dependent*.
- Hard to teach specifics …
- We will however see how a specific business context can be approached and what questions a data scientist should ask.
- This is equally important in industry and many areas in academia.

The Business Case

- A **business objective** can be many things
  - Profit in a public company
  - Maximise the number of people saved by vaccine
  - Remove maximum amount of CO2 from a process
- A **business case** is a prescription of how to achieve the business objective in a project or activity

An Example

Let's assume we're given a classification task. There are different kinds of classification errors we can make.

		Actual outcome	
		Positive	**Negative**
Prediction	**Positive**	True Positive	False Positive
	Negative	False Negative	True Negative

An Example (cont.)

A false positive does often not come at the same cost as a false negative, e.g.

- Tests for disease (e.g. Covid rapid tests)
- Tests for more serious disease such as hepatitis
- A system making loan decisions
- A system given recommendations for granting parole

Part of a business case could be

- How many infections will we prevent?
- How many people will get the right treatment?
- How much money will we earn on loans?
  - How much do we stand to loose (ref. value-at-risk)?
- How many people will we falsely imprison?

These considerations are part of a **business case**.

A Word About Metrics and KPIs

- Projects in business are usually followed up by *metrics*
  - Metrics quantify certain aspects of the success of a project
- Key metrics that track overall success are called *Key Performance Indicators* (KPIs)
  - Good KPIs are directly linked to value creation
- Ideally one tracks the outcome of data-driven decision making with a KPI
  - Related concept: Reward functions and utility (from reinforcement learning)
  - WARNING: Utility functions usually don't make for very good KPIs
  - They track mostly only part of the overall outcome

How We Cover the Business Side:

The Projects!

- Take them seriously!
- Don’t just seen them as a data exercise!
  - Really think about the underlying business case.

The Basic Tools

Today, we will start with introducing some basic tools used during the lectures

- `Python`
- `Jupyter`
- `Pandas`
- `Scikit-learn` (if time allows)

Python

- More specifically: Python 3.10
  - You have several options: **Pyenv**, Hombrew/other PMs, Anaconda, …
- You should be somewhat familiar with programming
  - Ideally in Python
- Work in groups, learn from each other
- If you don’t know python: Dive Into Python 3
- Why?
  - Real programming language
  - Widely used
    - You can get help
    - Makes you hirable
  - Plenty fast for us
- Get a good text editor (VSCode, Emacs, Vim …)

Jupyter

- Jupyter lab will be used for teaching (the practical bits)
- Graphical
- Interactive
- Great tool for exploring and teaching
- For any serious work, use a script instead!
  - In particular, for your assignments
  - Think about writing some tests

Some remarks

- CS, Stats, Business - there's a lot to understand/work on
  - It's also hard to teach: Give feedback!
    - We can't read your mind!
- The course *will be challenging*
- Ask questions!