BERN WINTER SCHOOL – NATURAL LANGUE PROCESSING

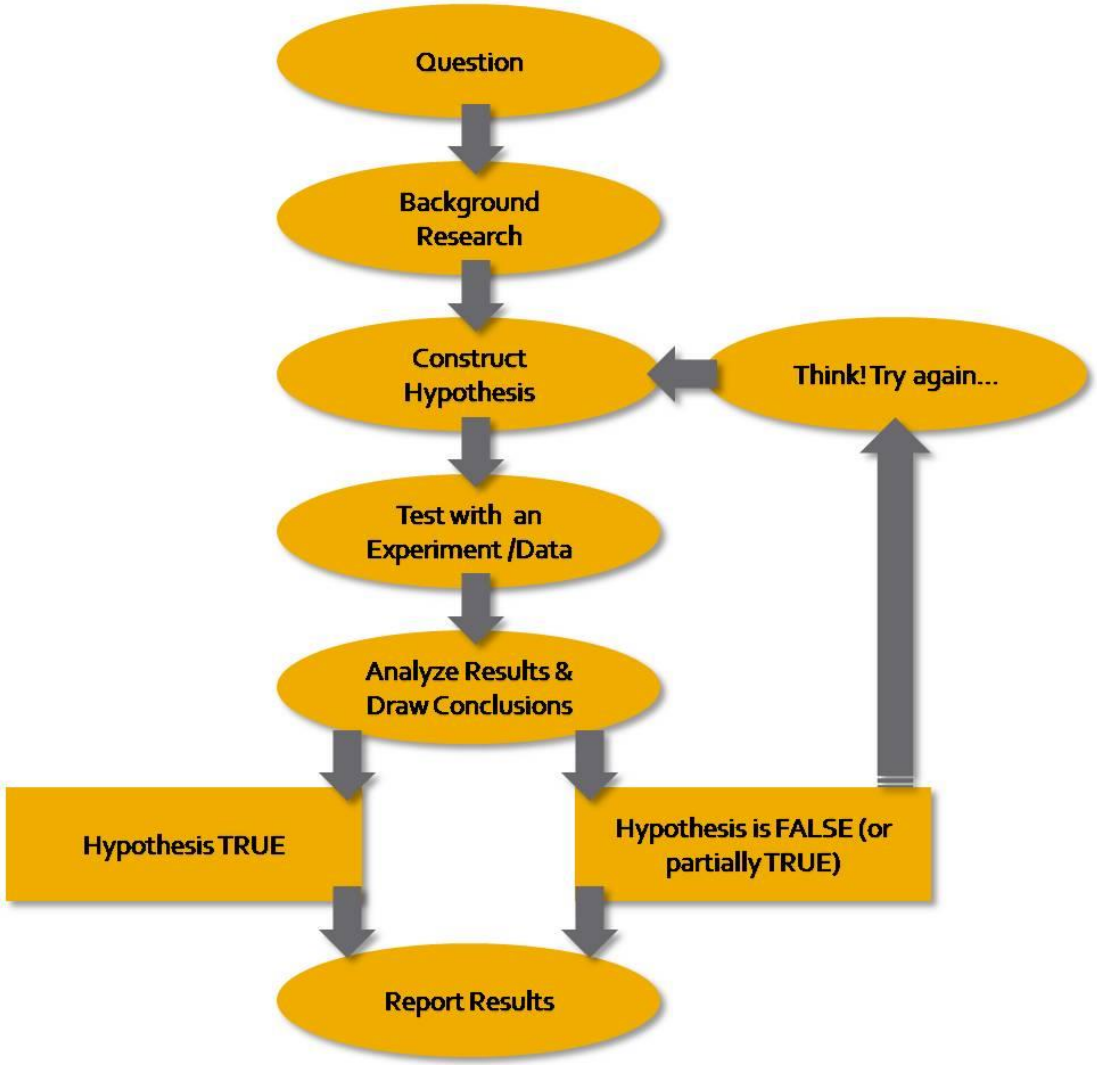
Ahmad Alhineidi

Content

- Get to know each other
- Machine learning intro (Slides influenced or by PD Dr. Sigve Haug)
- Set up for the school (software installation, google colab, virtual machine, general info)

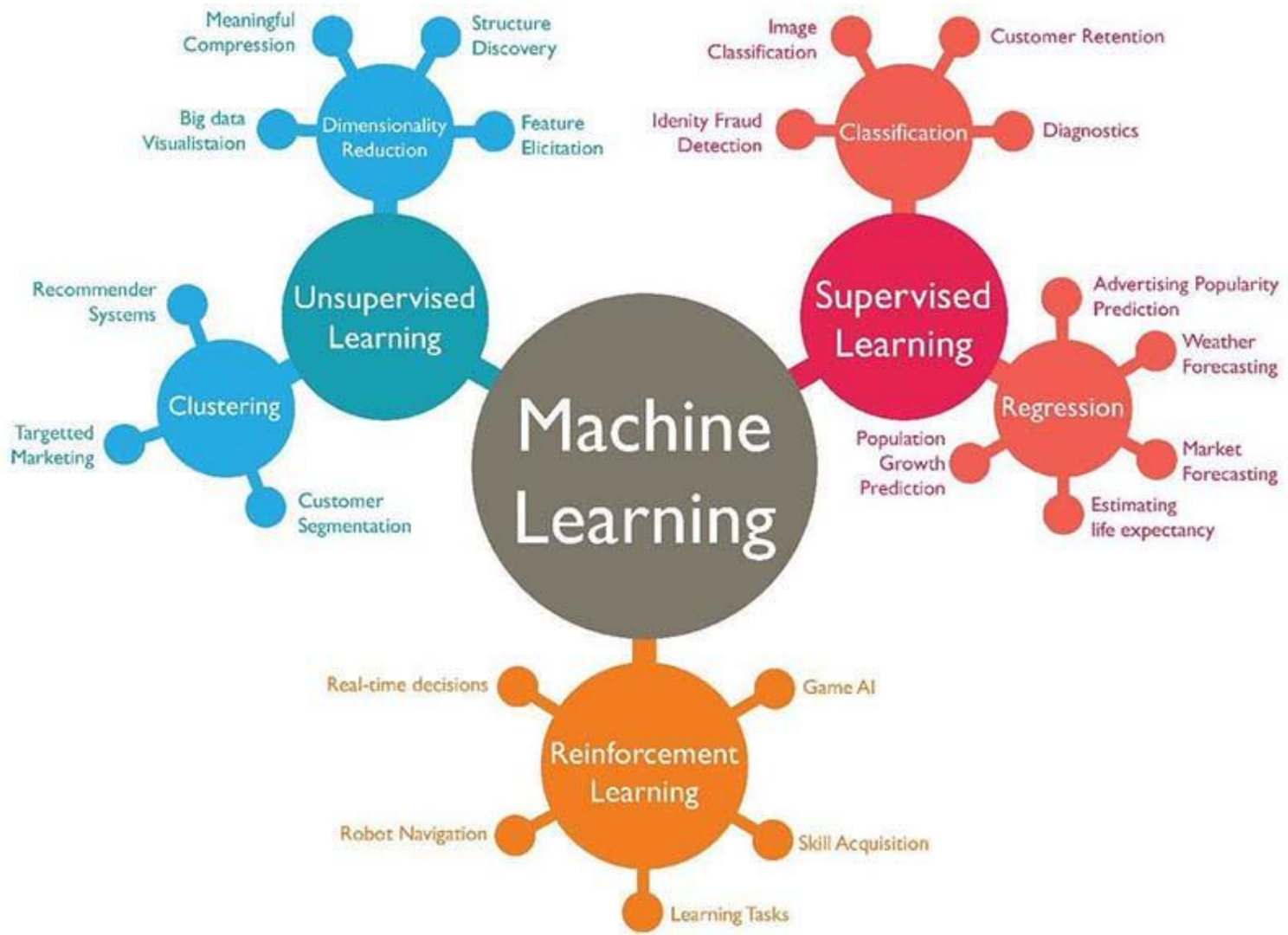
Get to know each other

- Background (study – work – interest)
- Natural and unnatural languages you speak/know
- Interest in NLP
- Anything else?



Machine learning Intro

- In science/data science the following loop represent the research process
- Machine learning has been popular method in the scientific process



Machine learning Intro

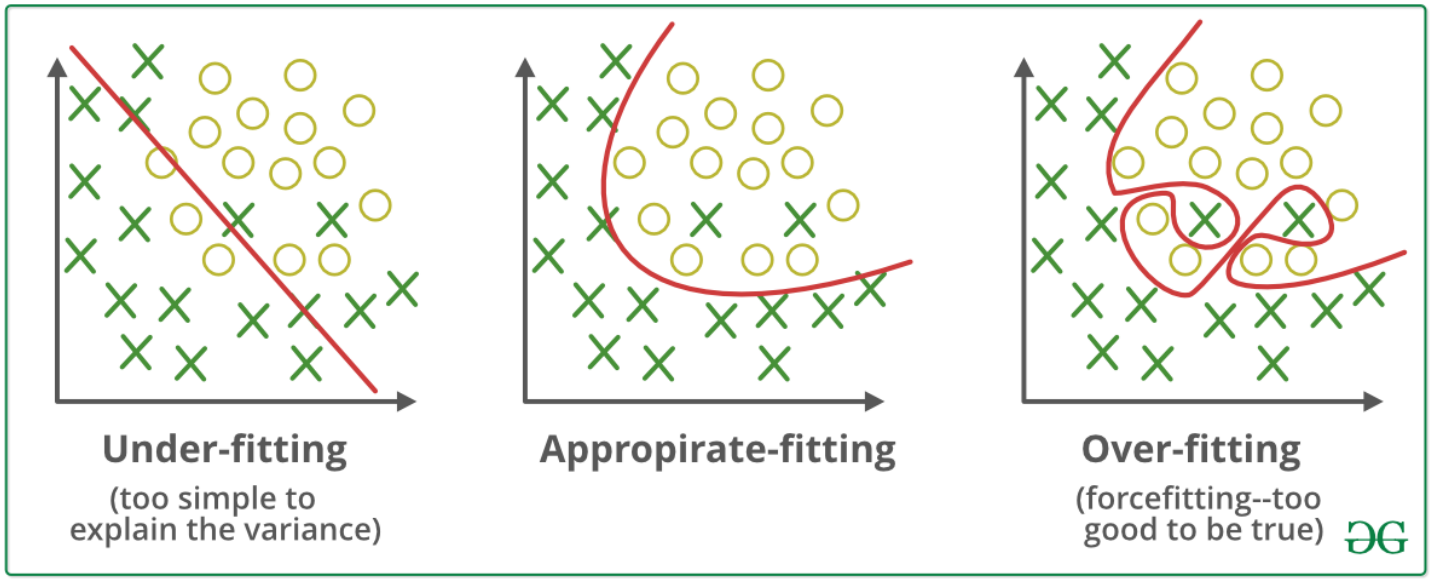
- Typical machine learning task classification with some application examples

Machine learning intro

- Some (classical) machine learning algorithms:
- Supervised learning (Linear Regression, Logistic Regression, Decision trees, Random Forests, Support Vector Machine)
- Unsupervised learning(K-mean clustering, Principal Component Analysis, Apriori Algorithm:)

- **TASK:** Talk to your neighbor about 1 of the mentioned algorithms and fill out a slide here (click) with 2-3 sentences about what the algorithm does. If you don't know the algorithm, try to look it up using chatgpt or other language model. (15 – 20 min)

OVERFITTING, UNDERFITTING, APPROPRIATE FITTING



Source: https://www.geeksforgeeks.org/underfitting-and-overfitting-in-machine-learning/

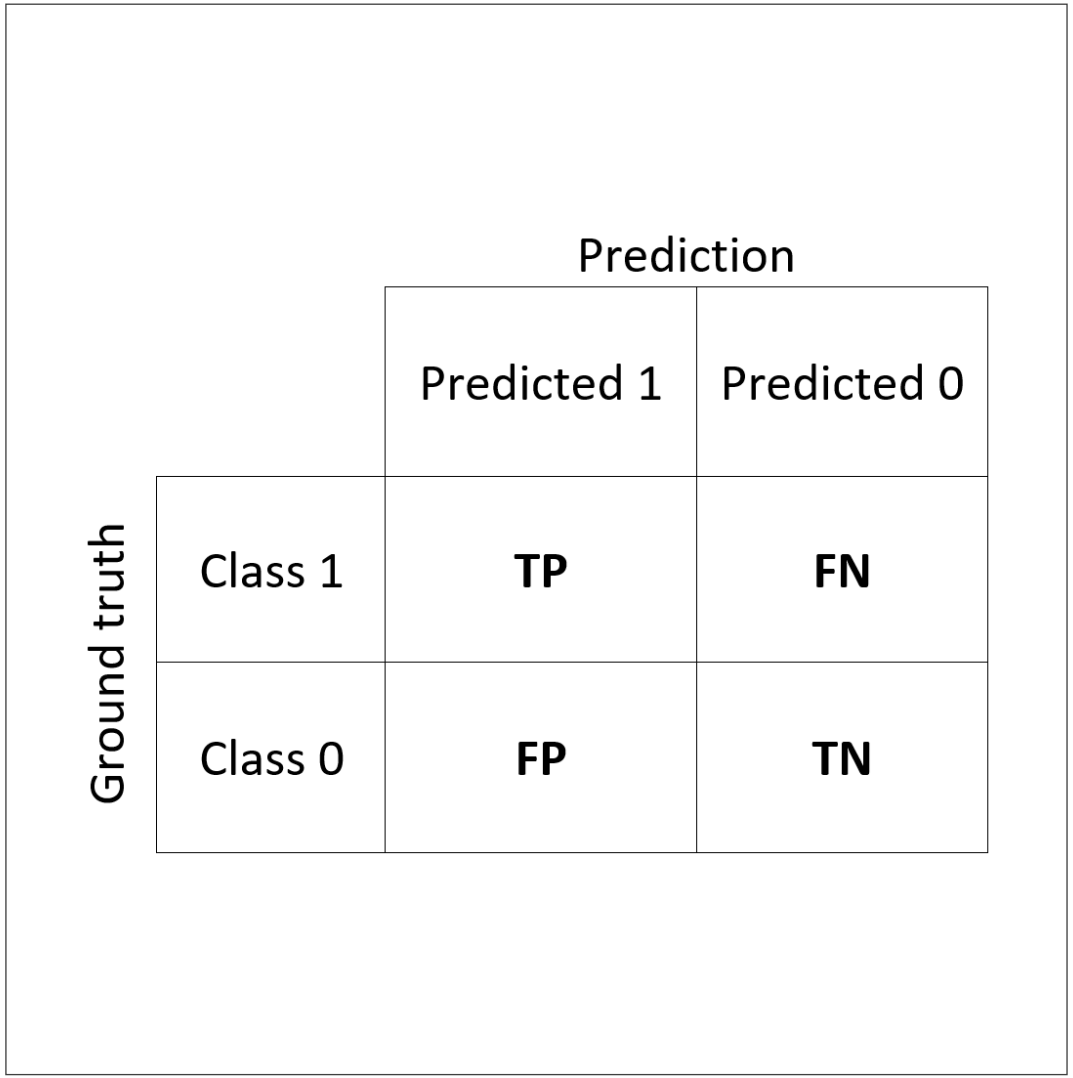
Performance measure

- empirical measurements to evaluate the ML algorithm
- Some ML algorithms works better for certain tasks, while performs suboptimal in others
- ML algorithms performance is measured differently depending on its type, sometimes application
- Mean square error, mean absolute error, F1, accuracy, recall, precision, BLEU, others

Evaluation: Regression

We usually measure distance for evaluating regression

- Mean Square Error: $MSE = \frac{1}{n}\sum_i (y_i - \hat{y}(\bar{x}_i))^2$
- Mean Absolute Error: $MAE = \frac{1}{n}\sum_i |y_i - \hat{y}(\bar{x}_i)|$
- Median Absolute Deviation: $MAD = \text{median}(|y_i - \hat{y}(\bar{x}_i)|)$
- Fraction of the explained variance: $R^2 = 1 - \frac{\sum_i (y_i - \hat{y}(\bar{x}_i))^2}{\sum_i (y_i - \bar{y})^2}$, where $\bar{y} = \frac{1}{n}\sum_i y_i$



Evaluation: Classification

- We can use the confusion matrix to visualize the model prediction in a classification task

Evaluation: Classification

- We can use the F1 score as a good metric for evaluating a classification system.
- F1 takes into consideration both the precision and recall

- Accuracy $= \frac{\mathrm{TP}+\mathrm{TN}}{\mathrm{TP}+\mathrm{FP}+\mathrm{FN}+\mathrm{TN}}$
- Precision $= \frac{\mathrm{TP}}{\mathrm{TP}+\mathrm{FP}}$
- Recall $= \frac{\mathrm{TP}}{\mathrm{TP}+\mathrm{FN}}$
- F1 $= 2\frac{\mathrm{Precision}\cdot\mathrm{Recall}}{\mathrm{Precision}+\mathrm{Recall}} = \frac{2\mathrm{TP}}{2\mathrm{TP}+\mathrm{FP}+\mathrm{FN}}$

Machine Learning example

- Google colab link in Ilias

Set up for school

- Install python

Why Python?

- Easy Syntax
- Free and Open Source
- Wide Support and Active Community
- String Handling
- Regular Expressions
- Natural Language Processing (NLP) Libraries
- Scraping Libraries
- Unicode Support
- Integration with Other Systems
- Machine Learning Libraries

```
from google.colab import files
uploaded = files.upload()
```

```
from google.colab import drive
drive.mount('/content/drive')
```

Use google colab?

- Don’t need to install anything on your device
- Can load data from your device or connect colab to your google drive

Work on your machine?

- Use venv module to create virtual environment for the school
- Python –m venv <env_name>
- Activate the env: source <env_name>/bin/activate
- Run: pip install –r requeirmens.txt #requirements.txt is in Ilias under “files, notebooks” folder
- Additionally run the following commands:

  >>python -m textblob.download_corpora lite
  >>python -m spacy download en_core_web_sm
  >>python -m nltk.downloader stopwords punkt

- See you at the Apero!