**3.15pm, 9th of June**
**Join Zoom Meeting**
**https://us02web.zoom.us/j/87996056293**

**Questions:**

- **Other activities this month? In July?**
- **Github accounts**
  - **https://github.com/Slowika/AI4GoodLab2020**
- **Future meetings:**
  - **Suggested times: Wed 12:45, Thursday 12:45**

1. Start off with Python:

- Setting up the Python environment
  - Install anaconda
  - Start using Jupyter Notebook
  - Writing a simple class (example: Vector2D)
    - HW: Vector3D (with cross-product)

  - Google Colab. Python Numpy arrays: https://cs231n.github.io/python-numpy-tutorial/ (how much of this have you seen earlier?)

2. Q&A on probability lecture
   - Q1: birthday paradox

N people in a room.
What is the probability of two of them having their birthdays on the same day?
Assumption: probability of being born on any given day is 1/365.
Each of the years has 365 days.

B - event that no two people have birthdays on the same day

P(A) = 1 - P(B)

#S = 365^n

$$\#B = 365 * 364 \ldots (365 - n + 1)$$

$$P(B) = \#B / \#S$$

- Q2: disease testing (Bayes rule)

98% - probability that an ill person is going to be classified as ill (true positive rate)
1% - probability that a healthy person is going to be classified as ill (false positive)
0.5% - percentage of the general population which has the disease

Question: What is the likelihood that a person who tested positive is ill?

Events:
E - the person tests positive
F - the person is actually ill

P[E|F] = 0.98
P[E|F^c] = 0.01
P[F] = 0.005
P[F^c] = 0.995

P[F|E] = ?

P[E] = P[E|F] * P[F] + P[E|F^c] * P[F^c]

P[F|E] = (P[E|F] * P[F]) / P[E] =
= (P[E|F] * P[F]) / (P[E|F] * P[F] +
P[E|F^c] * P[F^c]) = …
Comment: the name of the rule. Answer:
Sum rule and chain rule

**Sum rule**

X - event

$A_1, A_2, \ldots, A_n$ - disjoint events that sum up to the entire state space

Then $P(X) = P(X|A_1)P(A_1) + \ldots P(X|A_n)P(A_n)$

**Chain rule**

$P[EF] = P[E|F]*P[F]$

Def. of conditional probability

$P[E|F] = P[EF] / P[F]$

Generalization of the chain rule:

$P[E_1E_2E_3..] = P[E1]P[E2|E1]P[E3|E2E1]...$

3. Discussing Assignment 1: please submit the final version by Thursday morning. Hints for each question during the meeting

1. b)
   Hint: Consider f_theta(x_i) to be a constant. What happens if a constant is added to a RV which follows a Gaussian dist?

   c) like(theta) - Use the definition from the lecture
   log like(theta)
   log (a * b) = log(a) + log(b)

   MSE - Mean Squared Error (loss function, commonly used in regression)

2. a) error distribution changes depending on the sample
   b)

3. Draw like(theta) with respect to theta to get MLE

To calculate the posterior mean and mode, you need the posterior distribution:
p(theta | HHH; alpha, beta) =
(use Bayes rule)

Mode - argmax p(theta | HHH; alpha, beta)
Mean - expectation (integral of theta * probability density function * dtheta from 0 to 1)

**Notes after the meeting:**