AI in Medicine I
WiSe 2022/23

Technical University Munich
Department of Informatics

I31 - AI in Medicine and Healthcare
I32 - Computational Imaging in AI and Medicine

Theoretical exercise 6 **19. Dec. 2022**

Differential Diagnosis

The solutions will be discussed in the tutorial session

22. Dec 2022, 4-6 p.m. in lecture hall 5901.EG.051

For questions regarding this exercise sheet, please contact: `haifa.beji@tum.de`
For general questions, please contact: `course.aim-lab@med.tum.de`

1 Multiple choice questions

Answer the following multiple choice questions. For every question, at least one of the provided answers is correct. A point is rewarded only if all answers for a given question are correct.

1. (2 points) What is differential diagnosis?
   - ◯ The process of differentiating between probability of one disease versus that of other diseases with similar symptoms that could possibly account for illness in a patient.
   - ◯ It consists of regular medical checkups, which may include a physical exam, blood tests, and imaging tests. This will check for health problems that may occur during the follow-up period.
   - ◯ A method of analysis of a patient's history and physical examination to arrive at the correct diagnosis.
   - ◯ It involves a process of elimination of more or less probable hypothesis by further medical tests and other processing, until only one candidate disease or condition remains as probable.
2. (2 points) What is not a model for diagnostic reasoning?
   - ◯ Bayesian inference
   - ◯ Pattern recognition
   - ◯ Diagnosis of exclusion
   - ◯ Clinical trials
   - ◯ Hypothetico-deductive
3. (2 points) What is the first step clinicians must iterate on to arrive at a differential diagnosis?
   - ◯ Perform medical tests to determine the actual diagnosis.
   - ◯ Gather relevant information about the patient and create a symptoms list.
   - ◯ Look at the signs the patient has and form a list of hypotheses

2 Open questions

1. (2 points) In a particular pain clinic, 10% of patients are prescribed narcotic pain killers. Overall, five percent of the clinic's patients are addicted to narcotics (including pain killers and illegal substances). Out of all the people prescribed pain pills, 8% are addicts.

   If a patient is an addict, what is the probability that they will be prescribed pain pills?

2. (2 points) Given the following statistics, what is the probability that a woman has cancer if she has a positive mammogram result?

   - One percent of women over 50 have breast cancer.
   - Ninety percent of women who have breast cancer test positive on mammograms.
   - Eight percent of women will have false positives.

3. (2 points) [Follow-up example in the lecture: The medical test paradox] Medical test reported to have an accuracy of 99%, for a disease that affects 0.1% of the population, if performed on $100,000$ people.

   We now wish to know what is the probability to be affected given two positive tests?

4. (3 points) Assume that the chances of a person having a skin disease are 40%. Assuming that skin creams and drinking enough water reduces the risk of skin disease by 30% and prescription of a certain drug reduces its chance by 20%. At a time, a patient can choose any one of the two options with equal probabilities. It is given that after picking one of the options, the patient selected at random has the skin disease.

   Find the probability that the patient picked the option of skin screams and drinking enough water using the Bayes theorem.