Probabilistic Graphical Models in Computer Vision

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Weekly Exercises 0
Room: 02.09.023
Wednesday, 08.05.2019, 12:15 - 14:00

The theory part was **NOT** covered yet in this Monday's lecture. You can look them after the lecture on 06.05.

This exercise sheet aims to give a warm-up on probabilistic theory and programing in python. Doing it is optional but we highly recommend you to go through all the exercises.

This sheet will **NOT** be counted into the exam bonus and you do **NOT** need to submit.

We will discuss all of them on 08.05.

Intro to Probability

Exercise 1 (0 points). Consider an experiment: throwing two fair dices:

1. What is the sample space Ω?

2. Give an example of an event in this case.

3. Calculate the probability of the event you give.

Assume we have two events A and B from a sample space Ω, we introduce some notations:

1. $A\backslash B$: A occurs and B does NOT.

2. $\bar{A}$: A does NOT occur, i.e. $\bar{A} = \Omega\backslash A$.

3. $A \cup B$: either A or B occur.

4. $A \cap B$: both A and B occur.

Exercise 2 (0 points). Consider the same experiment: throwing two fair dices and find two events A and B so that following conditions are satisfied at the same time:

1. $P(A\backslash B) = P(A)$

2. $P(\bar{A}) = P(B)$

3. $P(A \cup B) = 1$

4. $P(A \cap B) = 0$.

Exercise 3 (0 Points). Show following properties:

1. $P(\emptyset) = 0$.

2. $A \subset B \Rightarrow P(A) \leq P(B)$.

3. $P(A \cap B) \leq \min(P(A), P(B))$.

4. $P(A \cup B) \leq P(A) + P(B)$.

5. $P(\Omega \backslash A) = 1 - P(A)$.

6. If $(A_i)_{i \in \mathbb{N}} \in \mathscr{F}$ is set of pairwise disjoint events s.t. $\bigcup_{i \in \mathbb{N}} A_i = \Omega$, then $\sum_{i \in \mathbb{N}} P(A_i) = 1$.

Exercise 4 (0 Points). Show following properties about expectation and variance:

1. $\mathbb{E}[a] = a, \forall a$ is a constant.

2. $\mathbb{E}[X + Y] = \mathbb{E}[X] + \mathbb{E}[Y]$.

3. $\mathbb{E}[\alpha X] = \alpha \mathbb{E}[X]$, α is a constant scalar.

4. $\text{Cov}[X, a] = \text{Cov}[a, X] = 0$, for any constant a.

5. $\text{Cov}[\alpha X, \beta Y] = \alpha \beta \text{Cov}[X, Y]$. ($\alpha$, β are constant scalars)

Intro to Python

Please see *python_ basics_ template.ipynb* for details. In case you have any problems about installing notebook, please check `https://jupyter.org/install`.