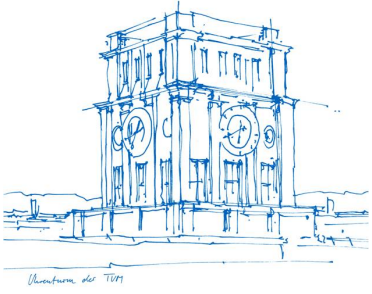
Computer Vision II: Multiple View Geometry (IN2228)

Exercise 00 Introduction

Viktoria Ehm

26 April 2022 16:00-18:00



Outline

- General Exercise Information
- Theoretical Exercises
- Practical Exercises

Exercise Information

➢ Exercise (120 minutes)

- Time: Wednesday from 16:00 to 18:00
- Room: 102, Hörsaal 2, "Interims I" (5620.01.102)

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Course Information

➢ Tentative Exercise Schedule

Please note that exercise sessions may be rescheduled depending on the course progress!

Wed 26.04.2023 Exercise 1: Introduction

Wed 03.05.2023 Exercise 2: Mathematical Background

Wed 10.05.2023 Exercise 3: Representing a Moving Scene

Wed 24.05.2023 Exercise 4: Perspective Projection

Wed 31.05.2023 Exercise 5: Lucas-Kanade Method

Wed 14.06.2023 Exercise 6: Reconstruction from two views

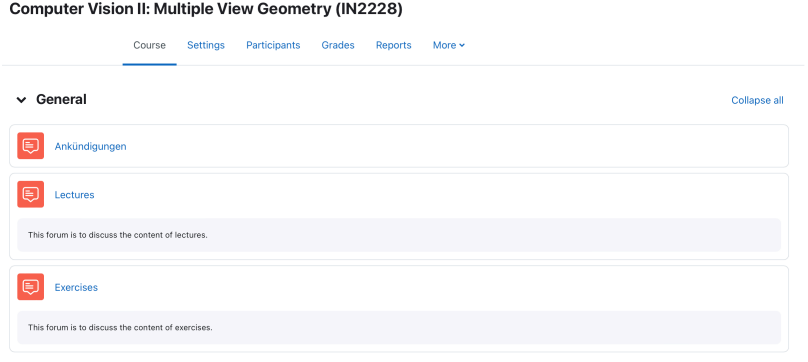
Wed 21.06.2023 Exercise 7: Reconstruction from multiple views

Wed 05.07.2023 Exercise 8: Direct Image Alignment

Wed 12.07.2023 Exercise 9: Direct Image Alignment

Questions regarding Exercise/Lecture Content

➢ Ask in the Moodle Forum not via Email (Course related emails will be ignored, personal questions can be asked via email)



Theoretical Exercises

- Will be provided one week before the corresponding exercise session on Moodle and the lecture website
- **No Grade Bonus** for theoretical exercises
- Very important for the exam preparation
- We highly recommend to do them
- Do them at home before the exercise session
- Solutions are discussed in the session

Theoretical Exercises

Multiple View Geometry: Exercise 1

Dr. Haoang Li, Daniil Sinitsyn, Sergei Solonets, Viktoria Ehm
Computer Vision Group, TU Munich

Wednesdays 16:00-18:15 at Hörsaal 2, "Interims I" (5620.01.102), and on RBG Live

Exercise: May 03, 2023

Math Background

1. Show for each of the following sets (1) whether they are linearly independent, (2) whether they span $\mathbb{R}^3$ and (3) whether they form a basis of $\mathbb{R}^3$:

   (a) $B_1 = \left\{ \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix}, \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \right\}$

   (b) $B_2 = \left\{ \begin{pmatrix} 2 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} \right\}$

   (c) $B_3 = \left\{ \begin{pmatrix} 2 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} \right\}$

2. Which of the following sets forms a group (with matrix-multiplication)? Prove or disprove!

   (a) $G_1 := \{A \in \mathbb{R}^{n \times n} | \det(A) \neq 0 \wedge A^\top = A\}$

   (b) $G_2 := \{A \in \mathbb{R}^{n \times n} | \det(A) = -1\}$

   (c) $G_3 := \{A \in \mathbb{R}^{n \times n} | \det(A) > 0\}$

3. Prove or disprove: There exist vectors $\mathbf{v}_1, ..., \mathbf{v}_5 \in \mathbb{R}^3 \setminus \{\mathbf{0}\}$, which are pairwise orthogonal, i.e.

$$\forall i, j = 1, ..., 5 : \quad i \neq j \implies \langle \mathbf{v}_i, \mathbf{v}_j \rangle = 0$$

Practical Exercises - Bonus

- Pass all 5 exercises to get the bonus
- 0.3 Bonus
- To pass an exercise you need to pass all tests of the corresponding exercise
- Only valid for the **first attempt**
- Only valid if you **pass** the exam
- Bonus Examples
  - 1.3 -> 1.0
  - 2.7 -> 2.3
  - 4.3 -> 4.3

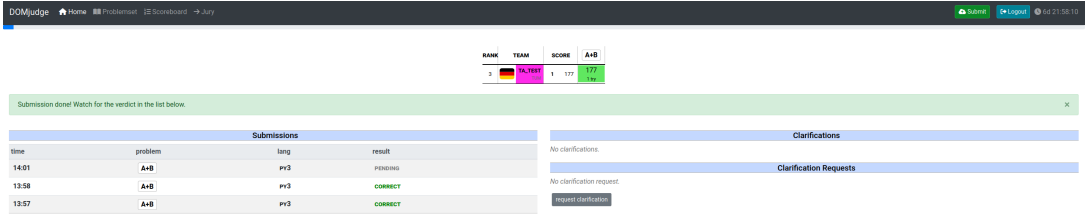
Practical Exercises - Anti-Plagiarism

- We have an **Anti-Plagiarism system**
- Every suspicion **will be reported**
- Not in your interest to cheat
- Bonus is a motivation
- Do not share code on Moodle (not questions and not answers)
- Do not share code with others

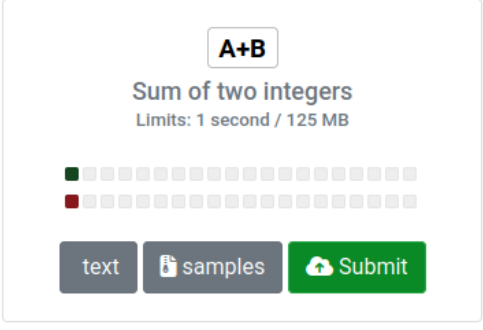
Practical Exercise Content

- Exercise can contain more than one task
- Language: Python or C++
- Two weeks for every practical homework
- Test exercise one week
- Deadline is Wednesday at 11am (1h before the lecture)

Practical Exercises - Demo

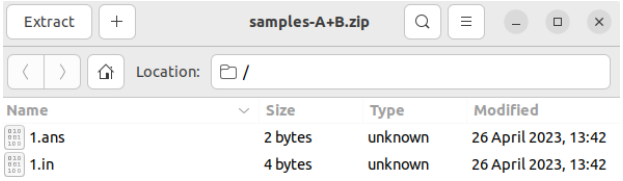


Practical Exercises - Demo



Text: Given two integers a and b, return the sum of the two integers

Practical Exercises - Demo Samples



1.ans: 4

1. in: 2 2

Input stream:2 2

Output stream: 4

Practical Exercises - Demo Solutions

- C++

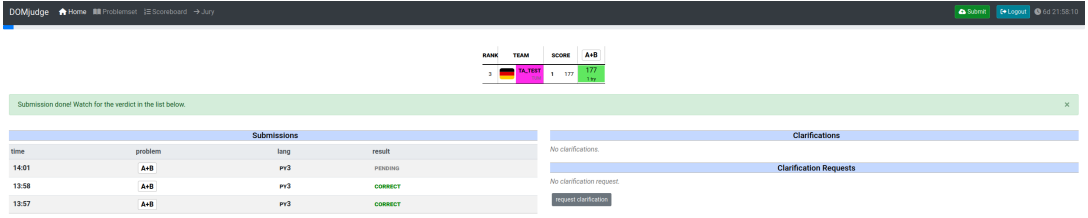
```
#include <iostream>

int main() {
  int a, b;
  std::cin >>a >> b;
  std::cout << (a + b) << std::endl;
  return 0;}
```

- Python

```
print(sum(map(int, input().split())))
```

Practical Exercises - Demo Samples

Practical Exercises - Demo



If you pass one submission run, you pass this exercise

Practical Exercises - Next Steps

- We have provided you with an username and a password by email today
- If you don't receive it today/tomorrow, please contact us via Email
- You can log in at https://domjudge.cvg.cit.tum.de/