Computer Vision and Deep Learning

Exam 1

1.

  1)

Ans:

$$5 \quad \underset{C(4\times1)}{\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}} = \underset{H(4\times4)}{\begin{bmatrix} R_{11} & R_{12} & R_{13} & T_1 \\ R_{21} & R_{22} & R_{23} & T_2 \\ R_{31} & R_{32} & R_{33} & T_3 \\ 0 & 0 & 0 & 1 \end{bmatrix}} \underset{W(4\times1)}{\begin{bmatrix} X \\ Y \\ Z \\ 1 \end{bmatrix}}$$

  2)

Ans:

$$\lambda \underset{I(3\times1)}{\begin{bmatrix} u \\ v \\ 1 \end{bmatrix}} = \underset{A(3\times3)}{\begin{bmatrix} \alpha & r & u_0 \\ 0 & \beta & v_0 \\ 0 & 0 & 1 \end{bmatrix}} \underset{C(3\times1)}{\begin{bmatrix} x \\ y \\ z \end{bmatrix}}$$

  3)

Ans:

$$\begin{cases} \lambda u = \alpha x + r y + u_0 z \\ \lambda v = \beta y + v_0 z \\ \lambda = z \end{cases} \Rightarrow \quad \begin{aligned} u &= \frac{\alpha x + r y + u_0 z}{z} \\ v &= \frac{\beta y + v_0 z}{z} \end{aligned}$$

5

4)

Ans:

Matrix H is also called <u>Affine Transform</u>

Matrix A is called <u>Projection Transform</u>

2. (**20%**, Camera Calibration)

1)

Ans:

Mahalanobis distance

2)

Ans:

Levenberg-Marquardt algorithm

3)

Ans:

$(5) \rightarrow (1) \rightarrow (3)$

3.

1)

Ans: (3), (6), (1), (4)

1. Scale-Space Extrema Detection

2. Keypoint localization

3. Orientation Assignment for each keypoint

4. Keypoint descriptor

2)

Ans: (2), (1), (3), (2)

(A) Edge feature

(B) Flat feature

(C) Corner feature

(D) Edge feature   (Won't occur??)

4.
Ans:

1)
(1) Feature extraction
(2) Classification

2)
(1) Local feature
(2) Medium feature
(3) Global feature

3)
AlexNet, VGG16, ResNet

5.

1)

Ans:

$$[w_1, w_2, w_3, \ldots, w_k, b]\begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_K \\ 1 \end{bmatrix} = Z$$

(a) 5

2)

Ans:

1) Cascade

2) Non-linear discrimination

3) Feature extraction

4) Down-sampling

5) Non-linear discrimination

6. **(6%)** For this class so far, please write your suggestions for professor Lien, Jenn-Jier James 連震杰 to improve his lecture? **(6%)** (At least 30 words, written in either English or Chinese. 用中文寫就好)

1) Positive site (Pros.):　　　　　　　　　　　2) Negative site (Cons.):