Homework-11

Q1:

The following is a picture of a 3D box.

A picture containing table, game, white, room

Description automatically generated

1. Identify 3 vanishing points and mark them (on the page) as (u1, v1), (u2, v2), (u3, v3).

A close up of a logo

Description automatically generated

2. Without knowing anything about the camera constant f, is it possible that the principal point is at the point that you have chosen for (u1, v1)? Explain your answer.

Answer: No

For two sets of parallel lines with two vanishing point (u1, v1), (u2, v2),

(u1 – u0)(u2 – u0) + (v1 – v0)(v2 – v0) + f^2 = 0

Assume the principal point is at (u1, v­1), then we have u0 = u1, v0 = v1.

0 \* (u2 – u1) + 0 \* (v2 – v1) + f^2 = 0

f = 0

But f = 0 is meaningless for a real world.

Contradiction. So, it is impossible that the principal point cannot locate at (u1, v1).

3. If it is known that the camera constant is f = 10, the camera location is at u = 10, v = 10, and the location of (u2, v2) in the image is u2 = 5, v2 = 30, compute the 3D direction of the parallel 3D lines that meet at that vanishing point.

u∞ - u0 = u2 - u = 5 – 10 = -5

v∞ - v0 = v2 - v = 30 – 10 = 20

Q2:

You are given the following information about a famous tennis player: His height is 210 cm, his legs are 90 cm long and the length of his face is 30 cm. The following diagram illustrates these measurements:

A close up of a logo

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Measurements were taken from picture of 5 tennis players. The pictures are distorted by perspective projection:

t1 height is 6 cm, legs are 2.2 cm long and length of face is 2 cm.

t2 height is 7 cm, legs are 2 cm long and length of face is 2 cm.

t3 height is 10 cm, legs are 2 cm long and length of face is 1 cm.

t4 height is 4.2 cm, legs are 1 cm long and length of face is 1.2 cm.

t5 height is 17 cm, legs are 9 cm long and length of face is 4 cm.

a. Which picture (from t1, t2, t3, t4, t5) is more likely to be the tennis player than all the others?

Answer: t4

Let’s use l, f and h to represent the length of legs, face and height.

CR4 is equal to CR0.

b. Which picture (from t1, t2, t3, t4, t5) is the second likely to be the tennis player?

Answer: t2

Except for t4,

|CR1 – CR0| = |0.2895 – 0.125| = 0.1645

|CR2 – CR0| = |0.16 – 0.125| = 0.035

|CR3 – CR0| = |0.0278 – 0.125| = 0.0972

|CR5 – CR0| = |0.3462 – 0.125| = 0.2212

CR2 is secondly close to CR0.