

Multiple view geometry: Exercise sheet 3

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Exercise 1

By painfully multiplying matrices we get

$$\lambda \begin{pmatrix} u \\ v \\ 1 \end{pmatrix} = \begin{pmatrix} fX + o_x Z \\ fY + o_y Z \\ Z \end{pmatrix}$$

Dividing by Z gives the result

Exercise 2

It is due to the fact that if we have $2X$ or $2Y$ in nominator and $2Z$ in denominator the factors of two are just cancelled

Exercise 3

Substituting the numbers in formula we have $u = 500$, $v = 540$. We don't need the units since we are working with ratios $\frac{X}{Z}$ or $\frac{Y}{Z}$. The point $(500, 540)$ exceeds the dimensions of image

Exercise 4

We just need to multiply intrinsics matrix with matrix of generic projection in Homogeneous coordinates

$$\begin{pmatrix} u \\ v \\ 1 \end{pmatrix} = \begin{pmatrix} f \cdot \frac{X}{Z} + 0 \cdot \frac{Y}{Z} + o_x \cdot 1 \\ 0 \cdot \frac{X}{Z} + f \cdot \frac{Y}{Z} + o_y \cdot 1 \\ 0 \cdot \frac{X}{Z} + 0 \cdot \frac{Y}{Z} + 1 \cdot 1 \end{pmatrix} = \begin{pmatrix} f \frac{X}{Z} + o_x \\ f \frac{Y}{Z} + o_y \\ 1 \end{pmatrix}$$