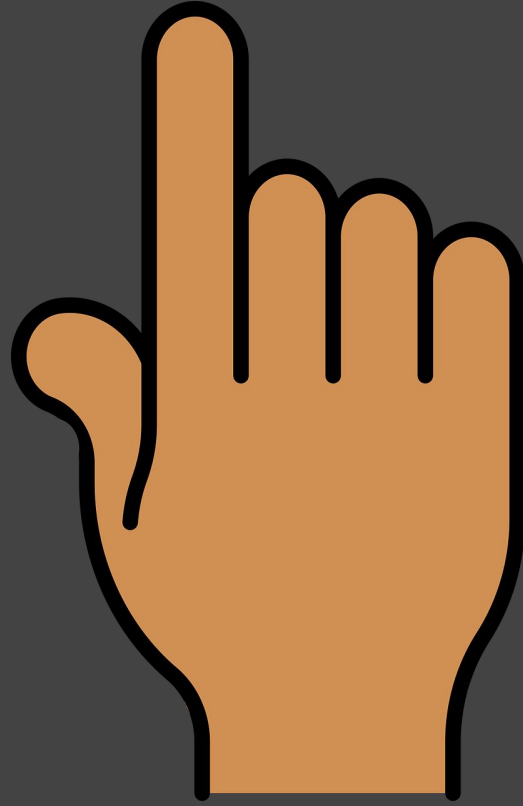
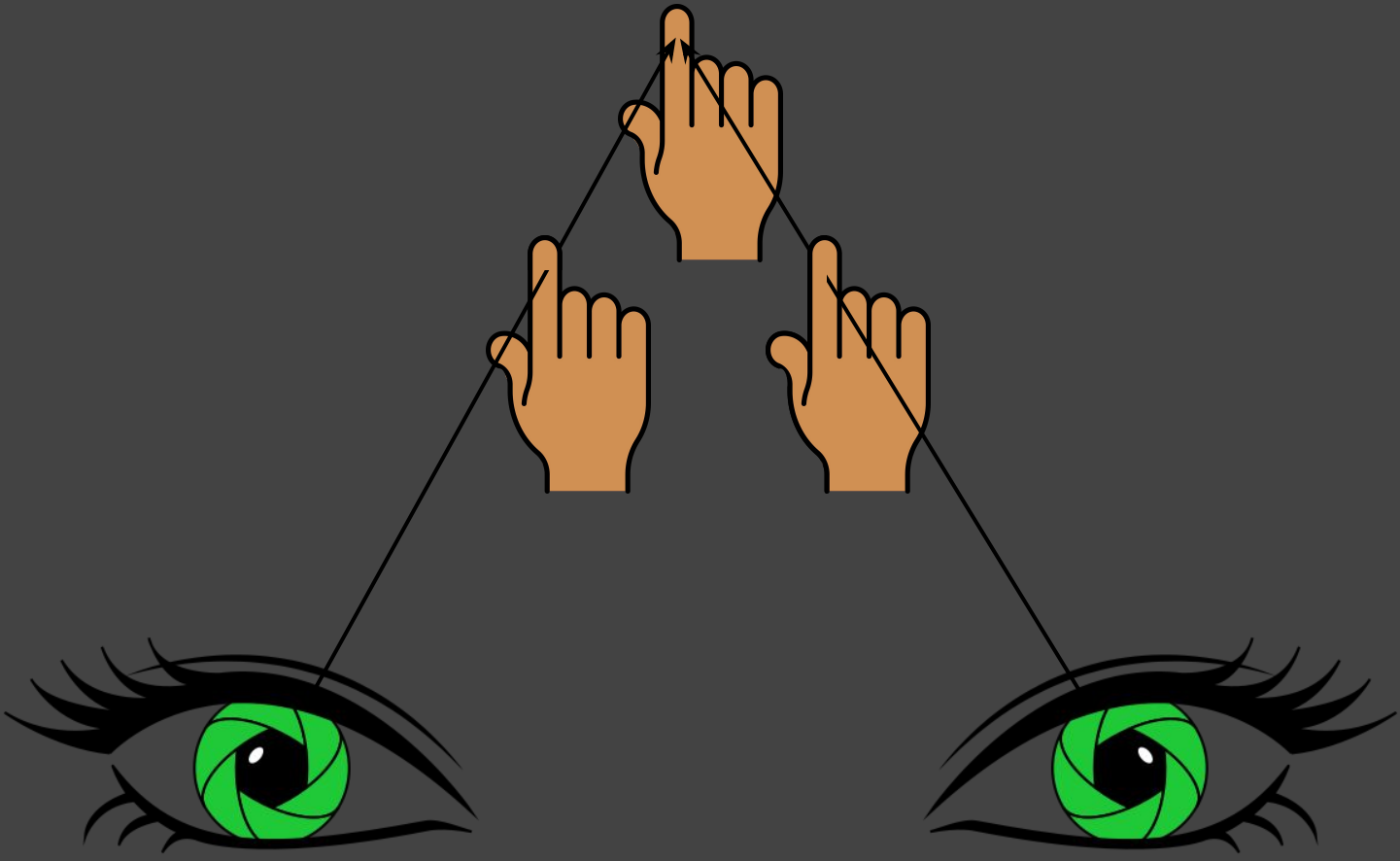


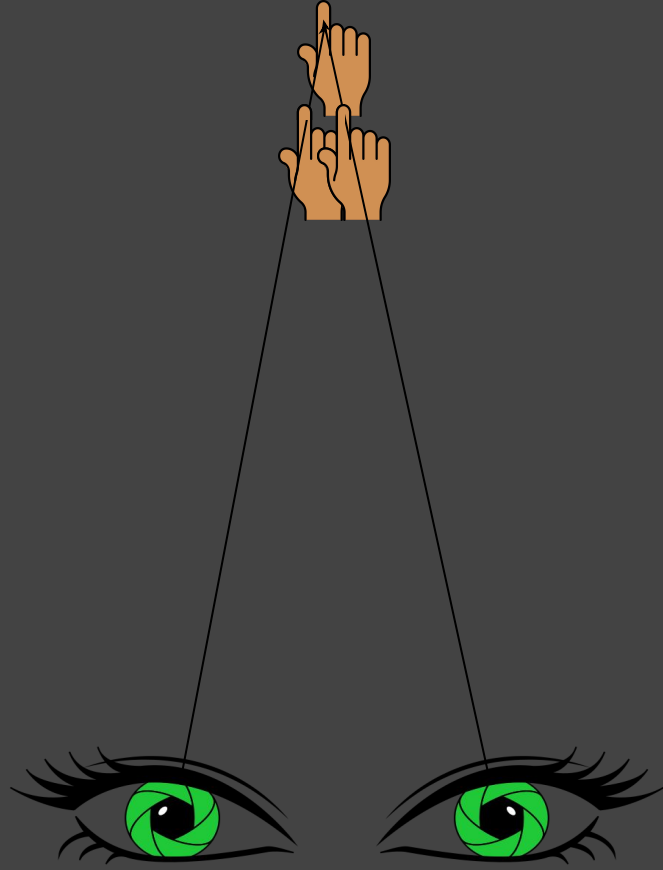
Understanding Depth And Disparity

Dalya Gartzman

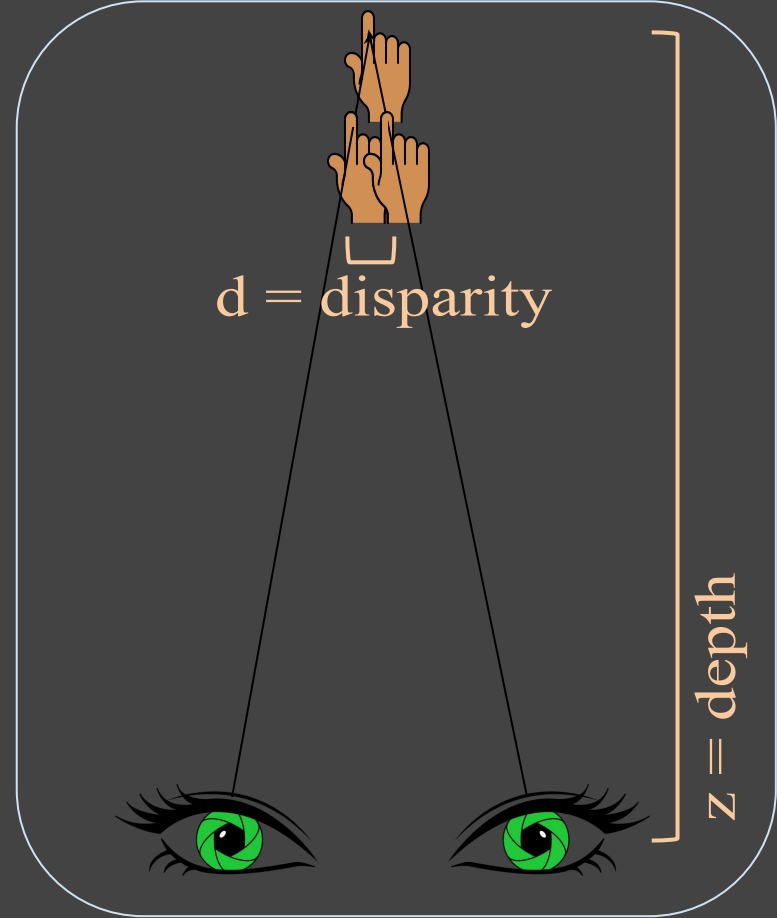
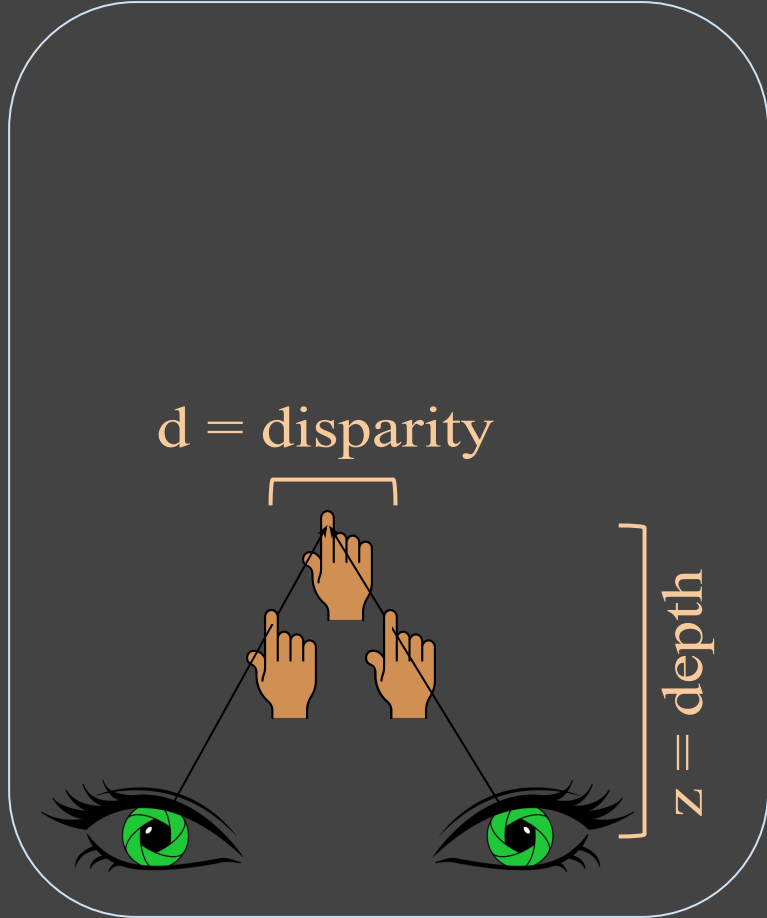
bit.ly/DepthAndDisparity



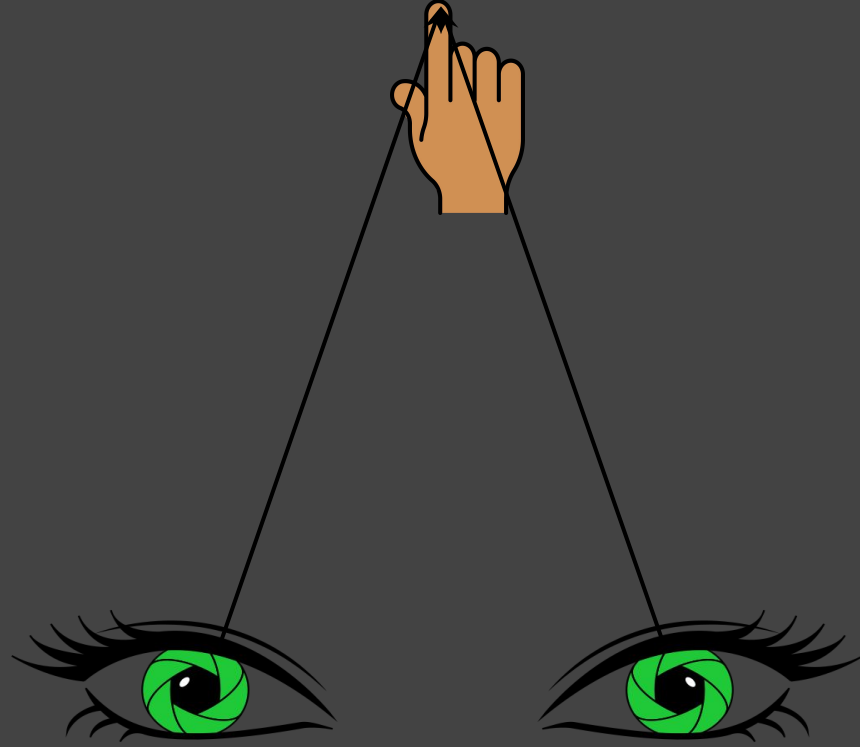




Inverse Relationship Between Depth and Disparity

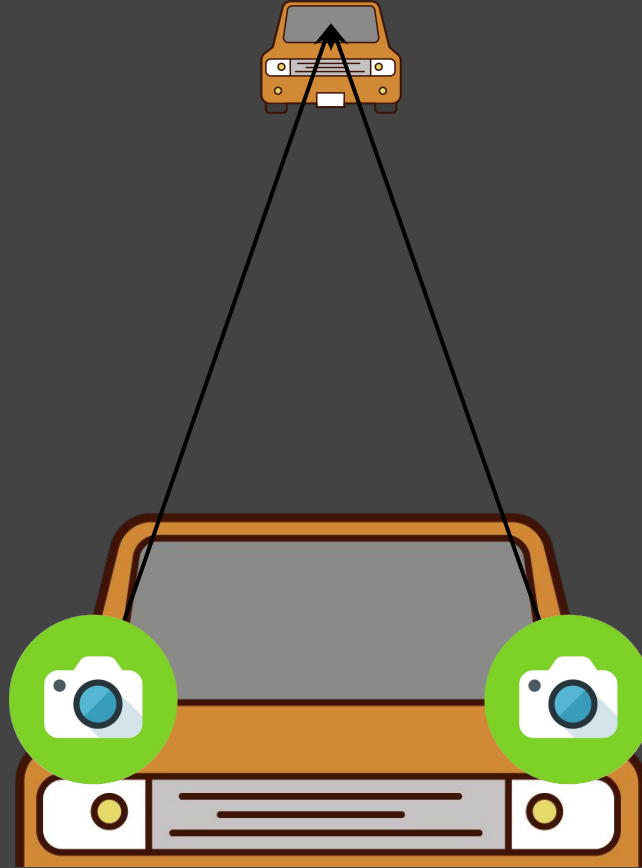


Goal: Calculating Depth in Stereo Vision



$Z = ?$

Goal: Calculating Depth in Stereo Vision

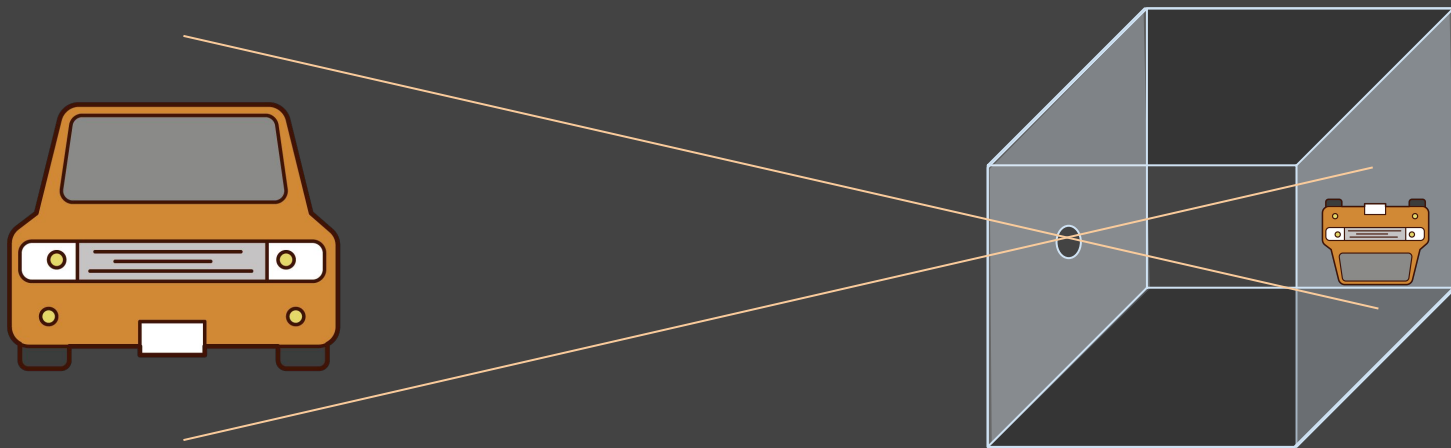


$$Z = ?$$

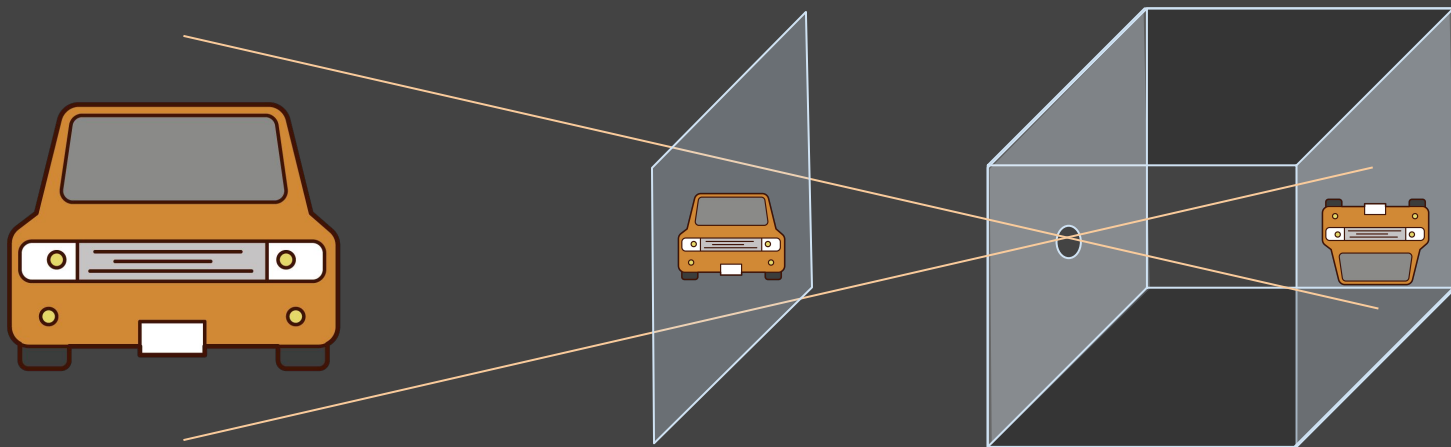
Understanding Depth and Disparity

- ☒ Motivation
- ☐ Laying Foundations
- ☐ Geometry!

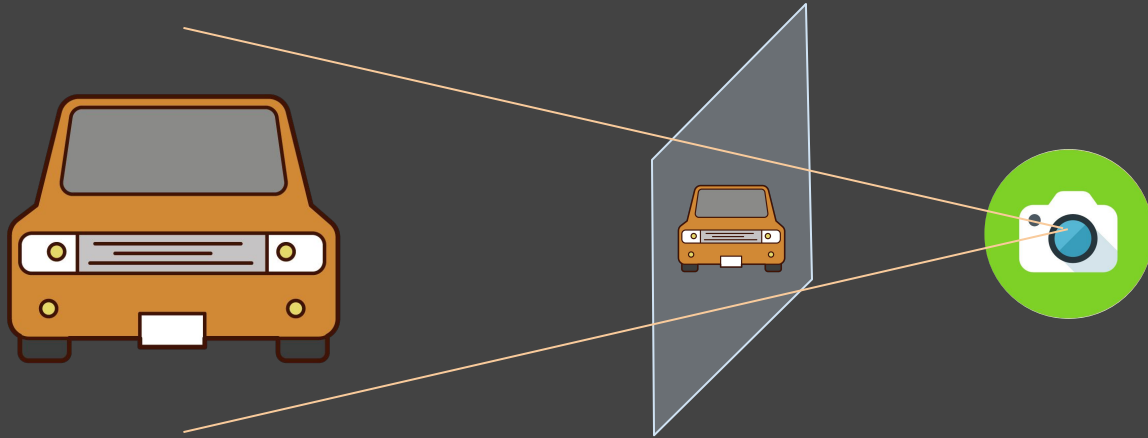
A Model of the Camera



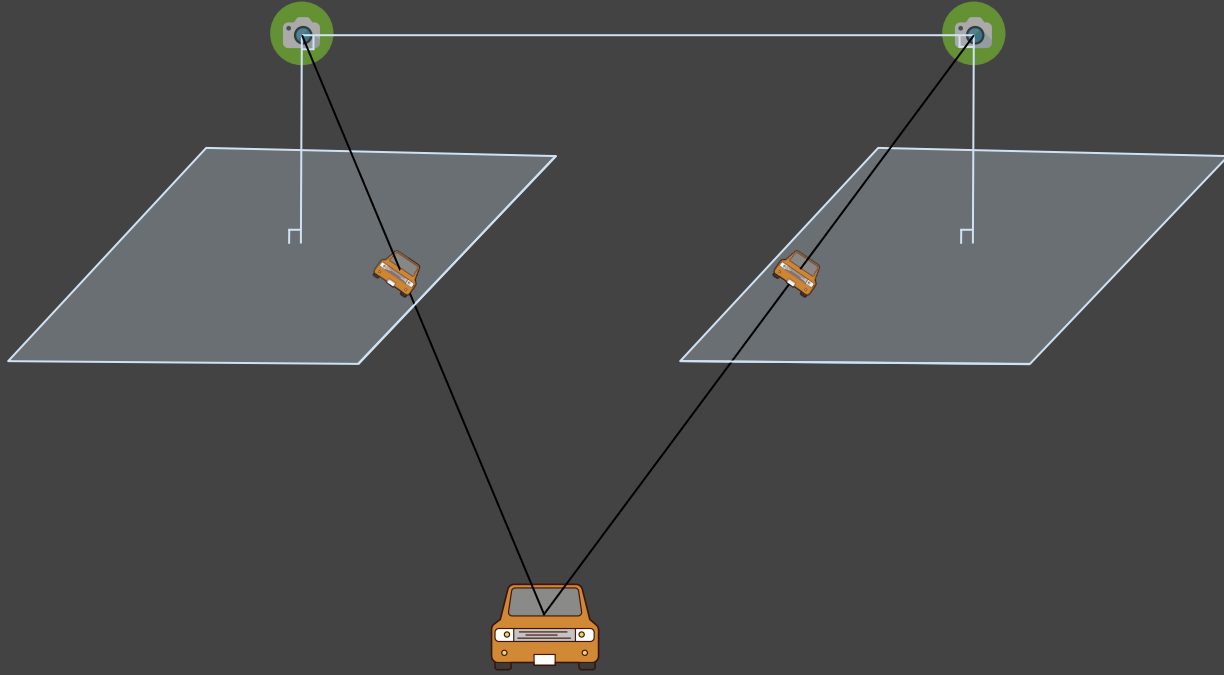
A Model of the Camera



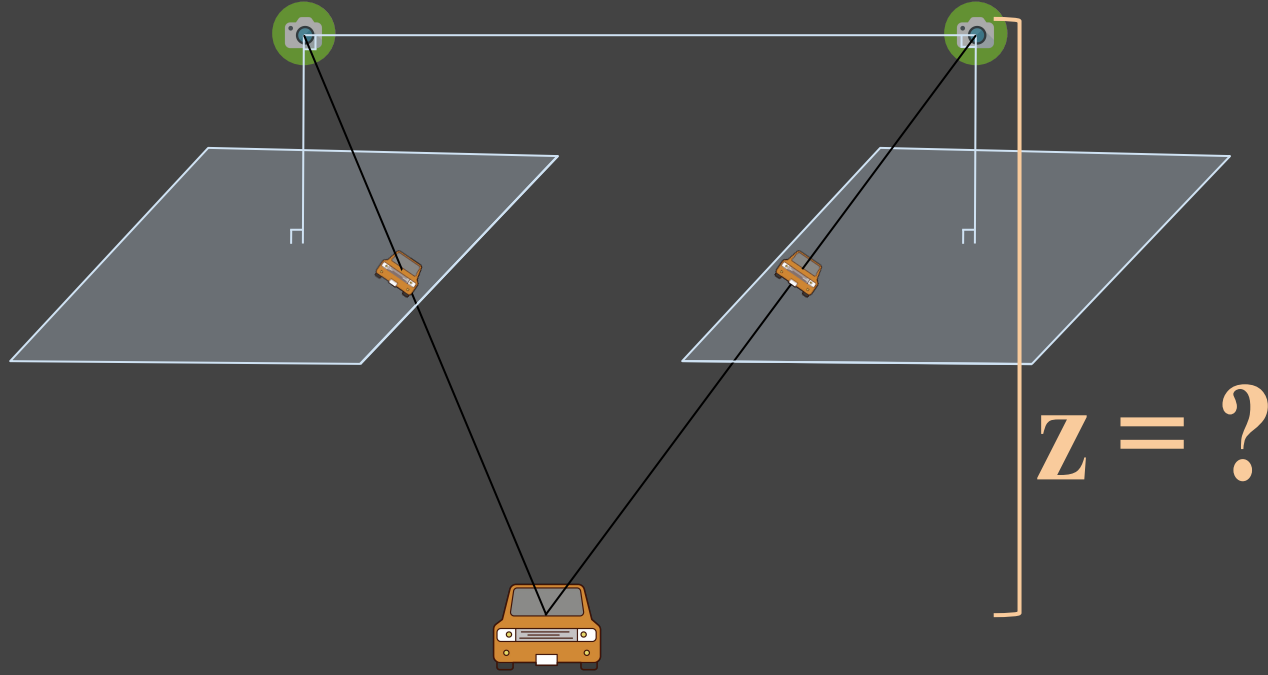
A Model of the Camera



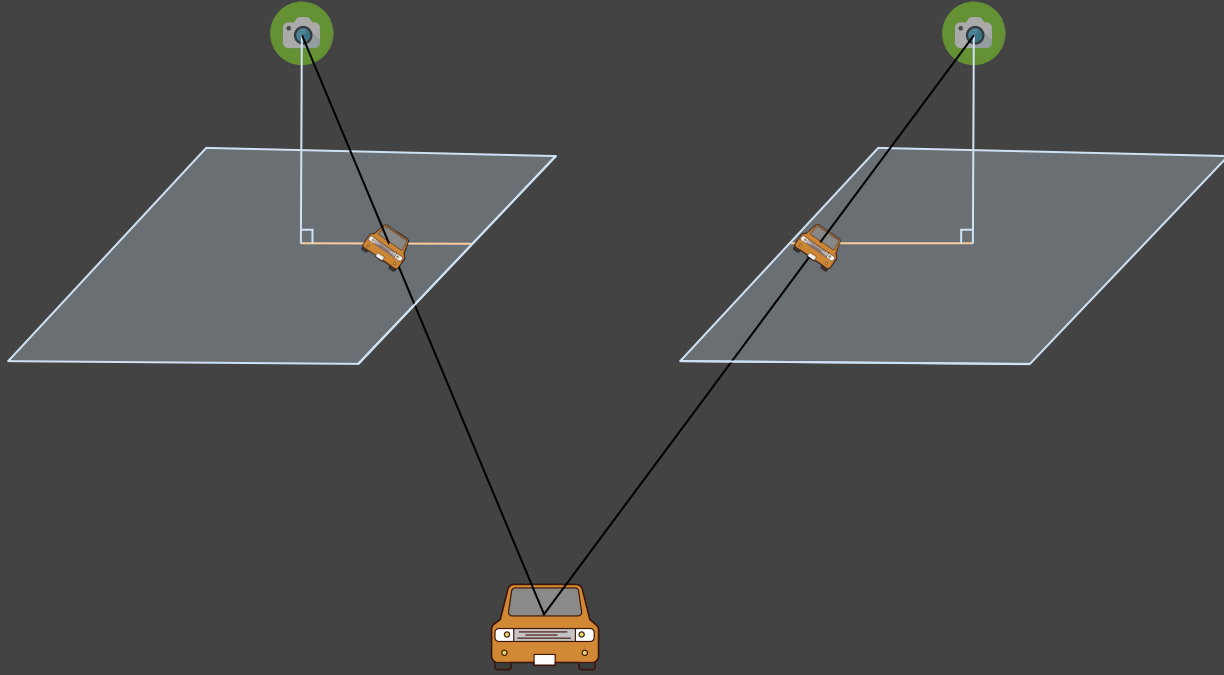
Stereo Vision



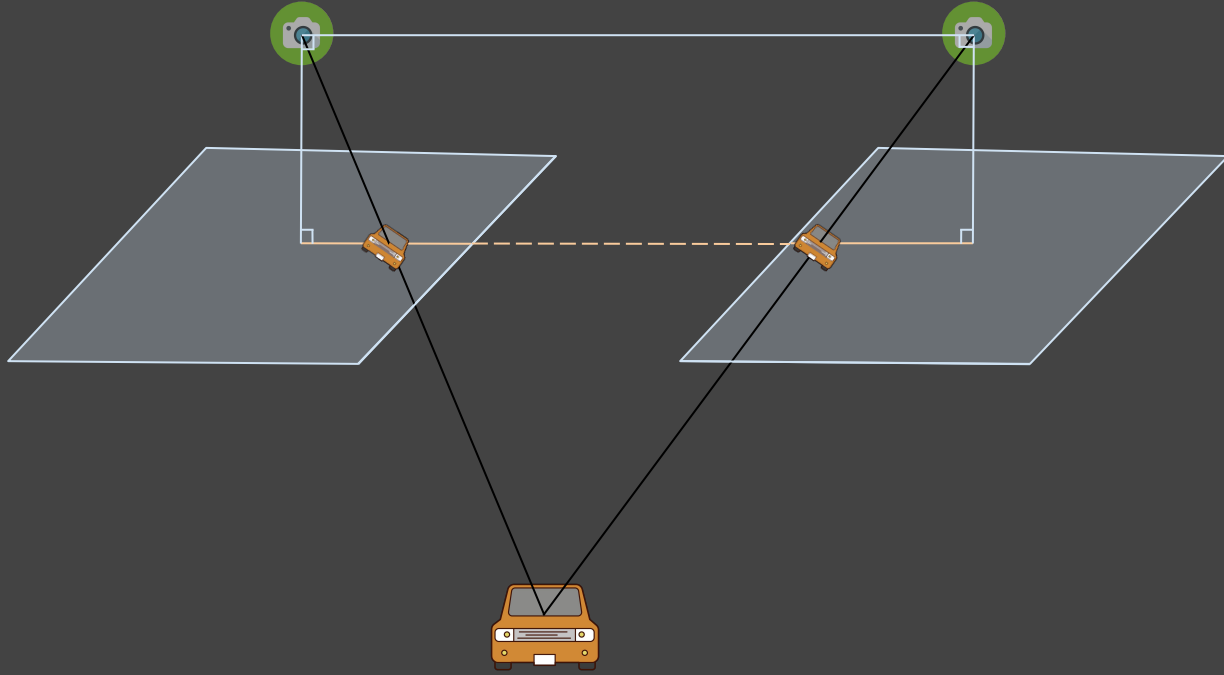
Stereo Vision



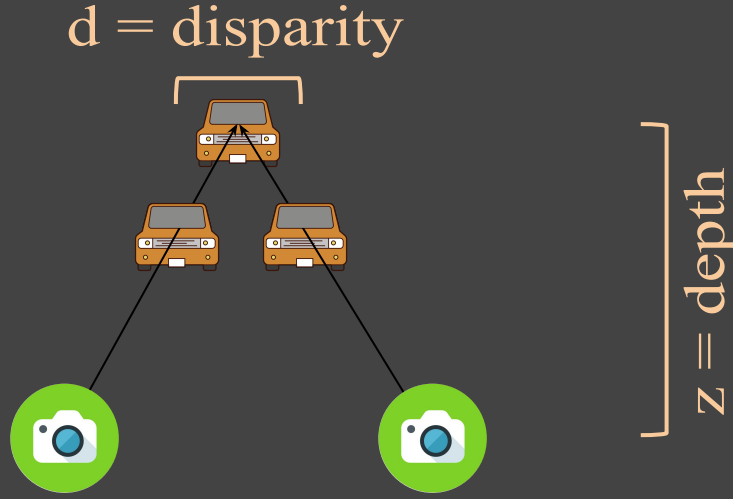
Stereo Vision



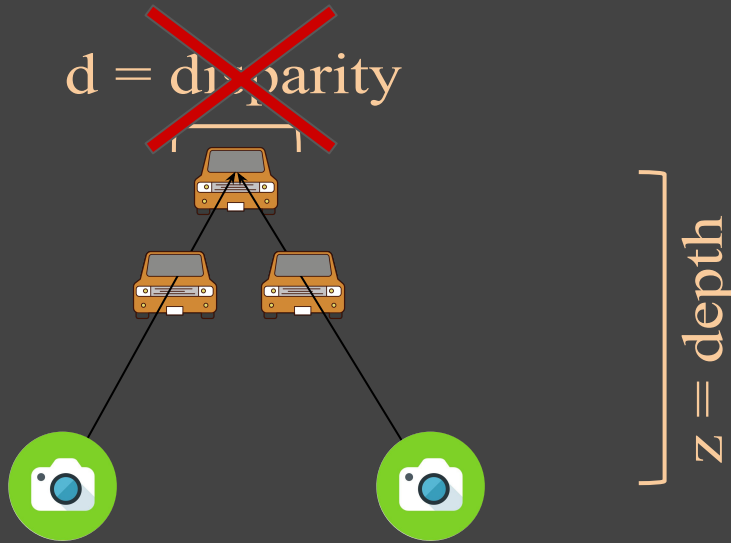
Stereo Vision



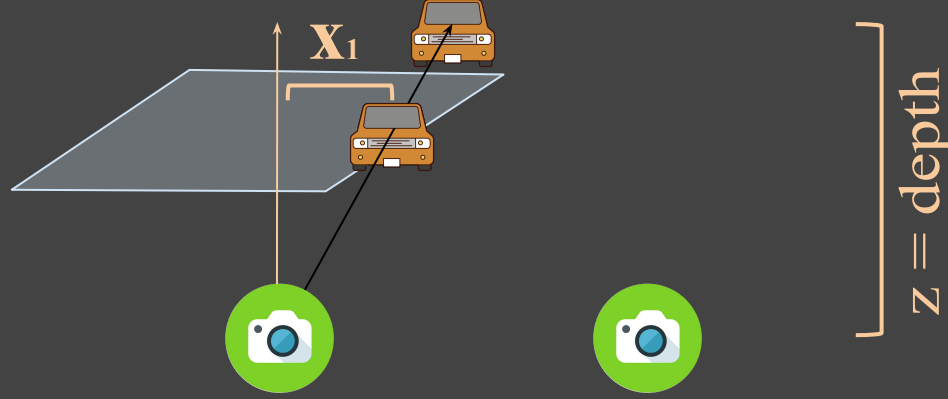
Defining Disparity



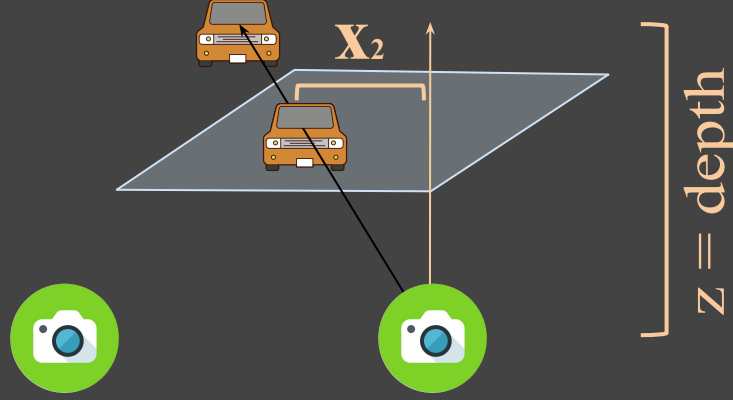
Defining Disparity



Defining Disparity

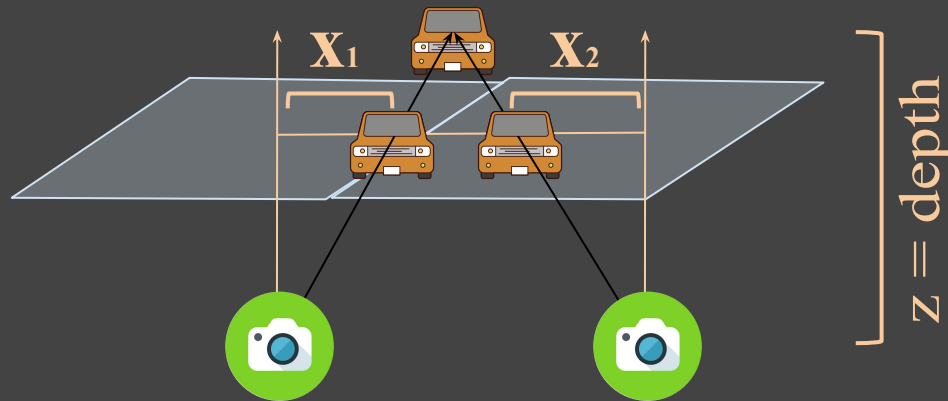


Defining Disparity

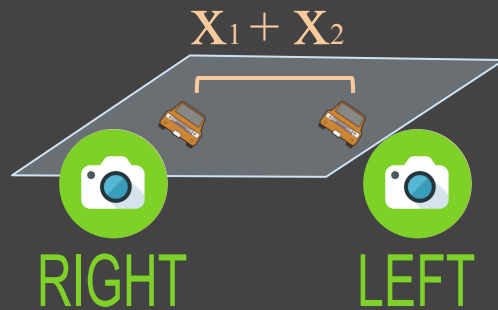


Defining Disparity

Define: $x_1 + x_2 = \text{disparity}$



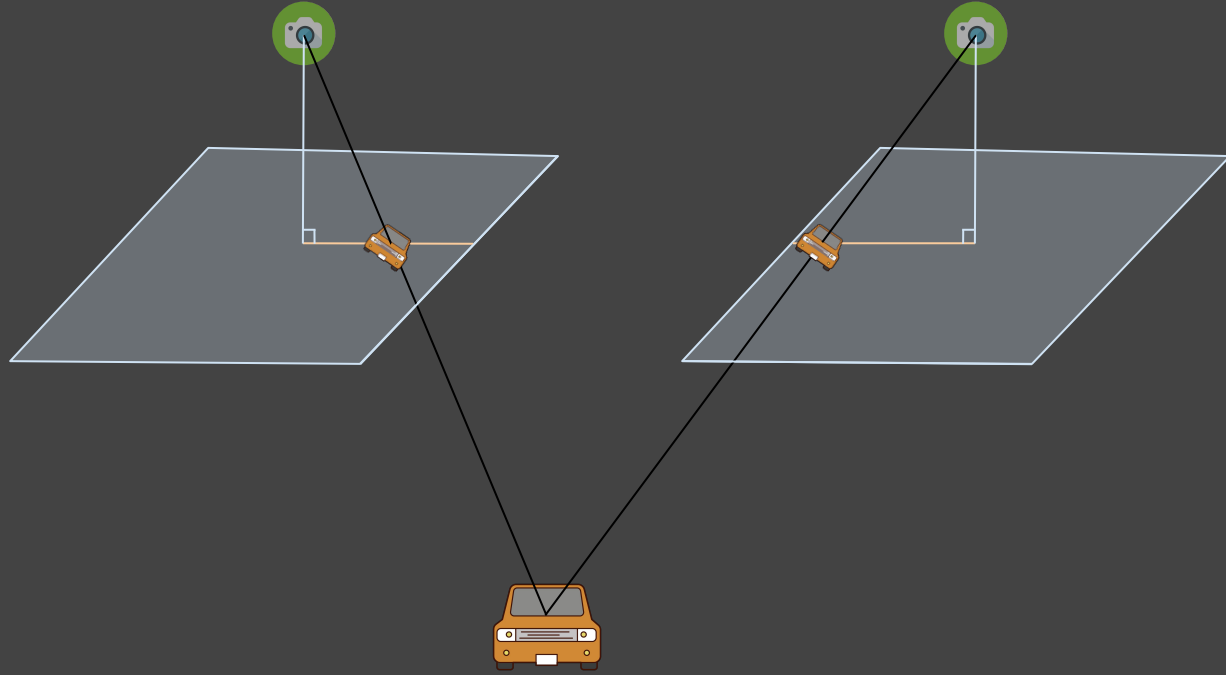
Defining Disparity



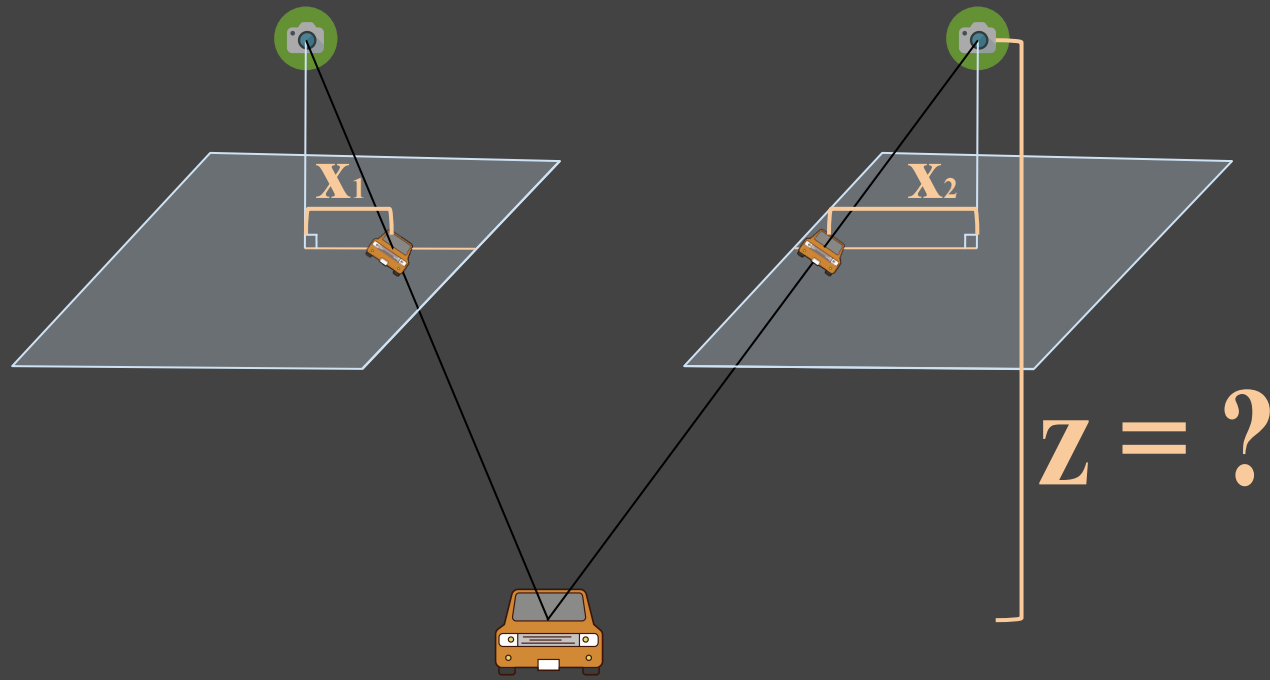
Understanding Depth and Disparity

- ☒ Motivation
- ☒ Laying Foundations
- ☐ Geometry!

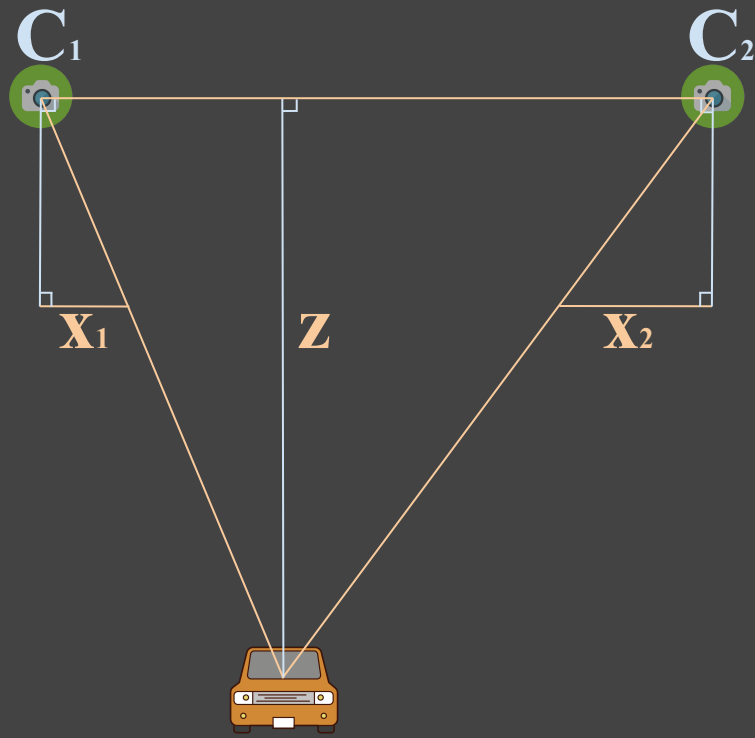
Let's Do Geometry!



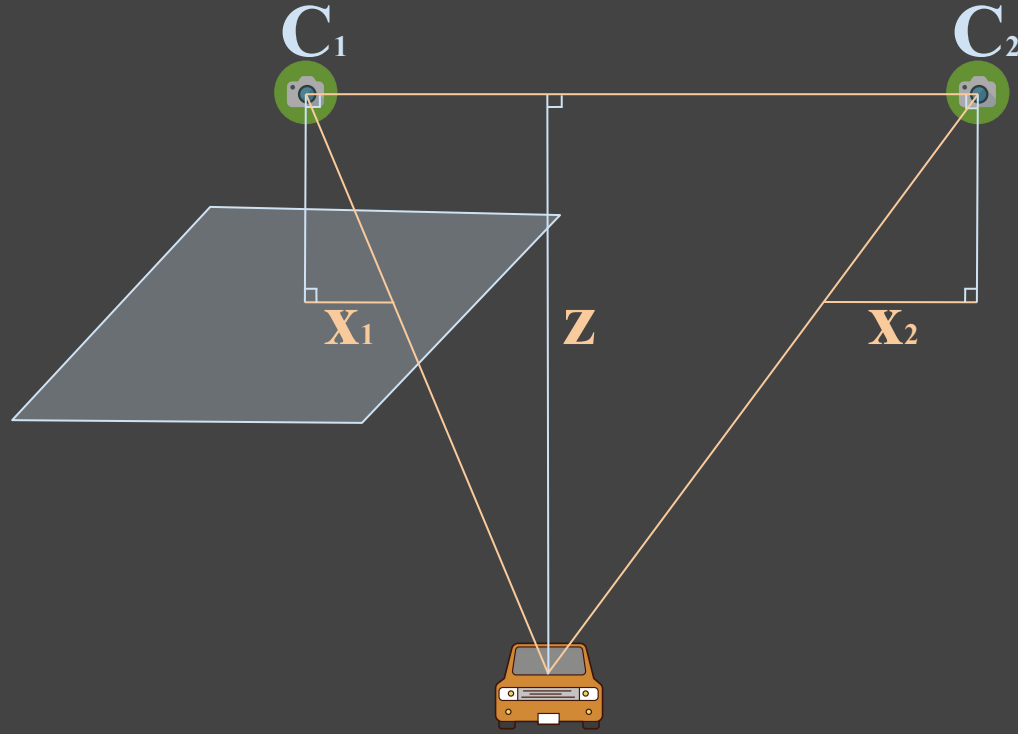
Let's Do Geometry!



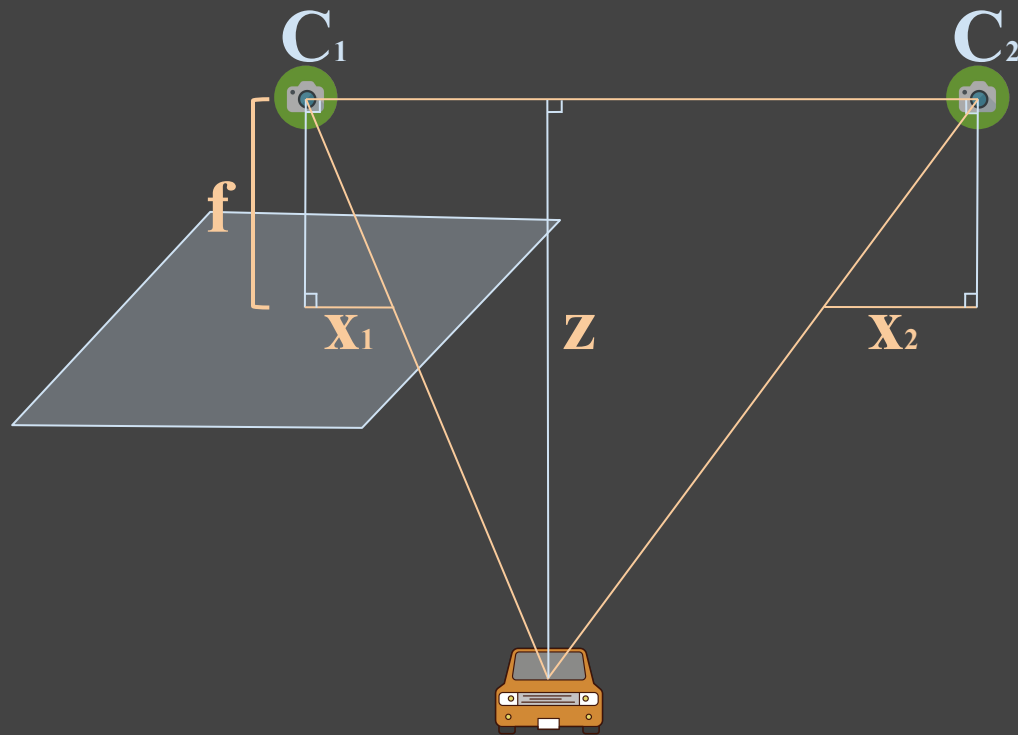
Let's Do Geometry!



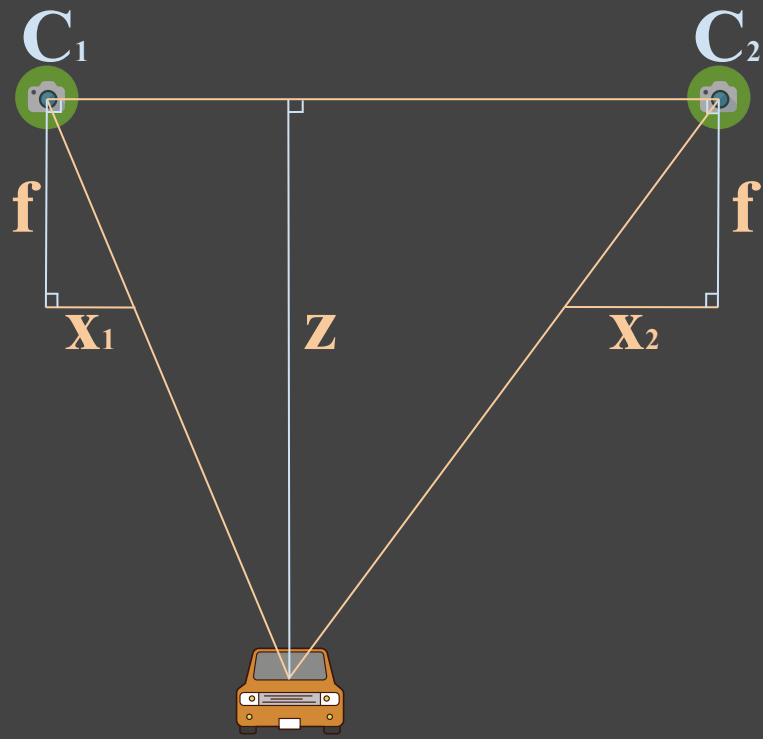
Let's Do Geometry!



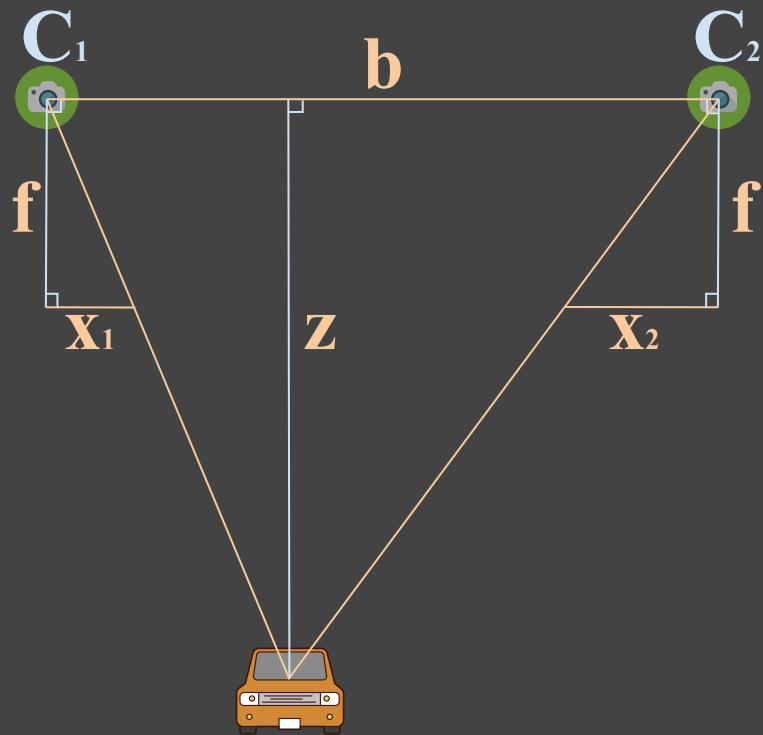
Let's Do Geometry!



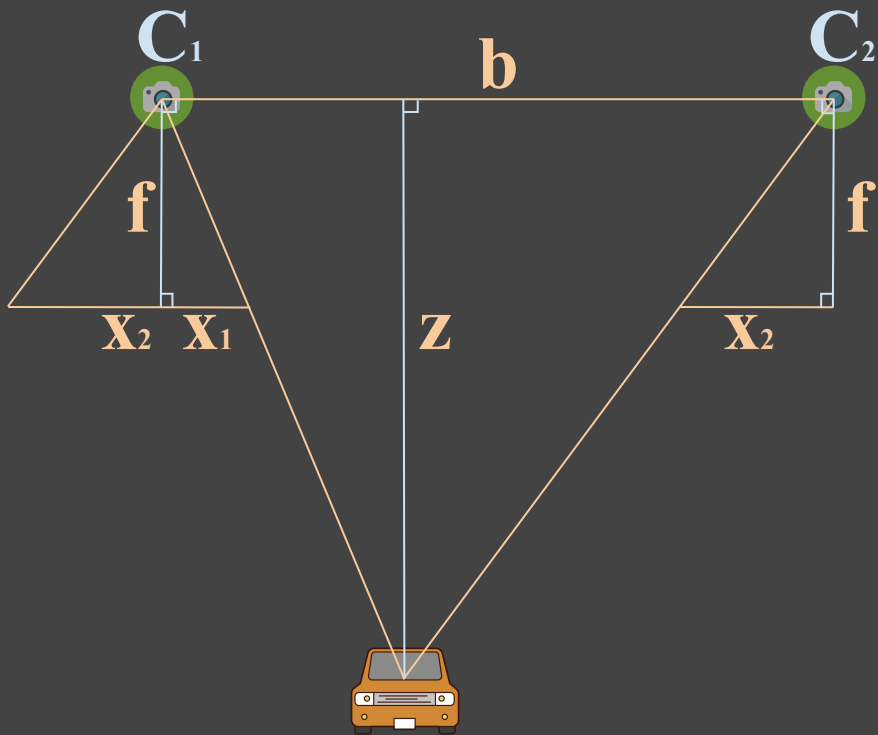
Let's Do Geometry!



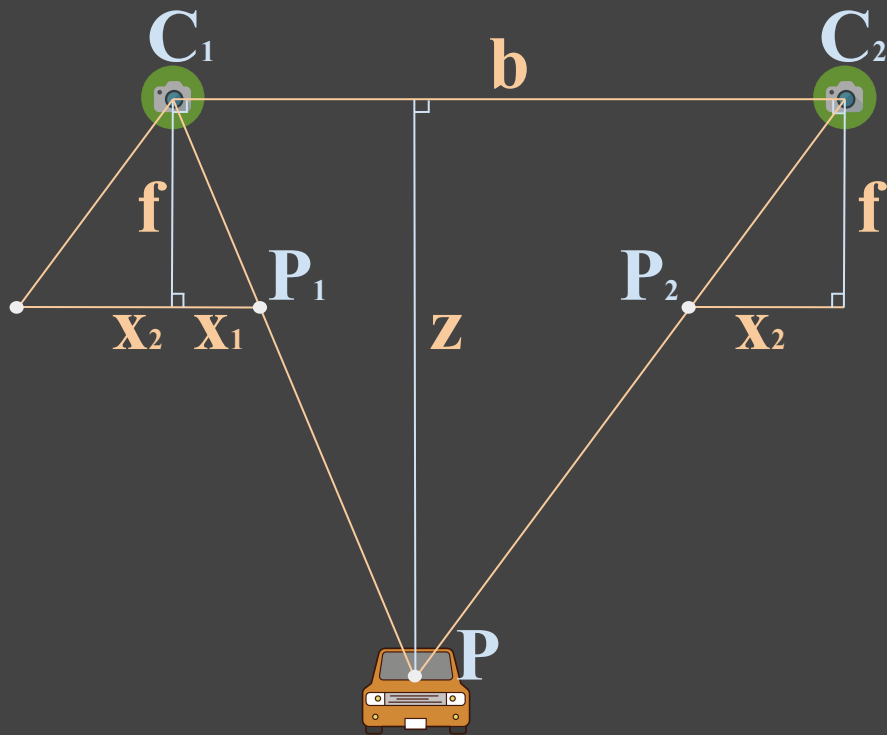
Let's Do Geometry!



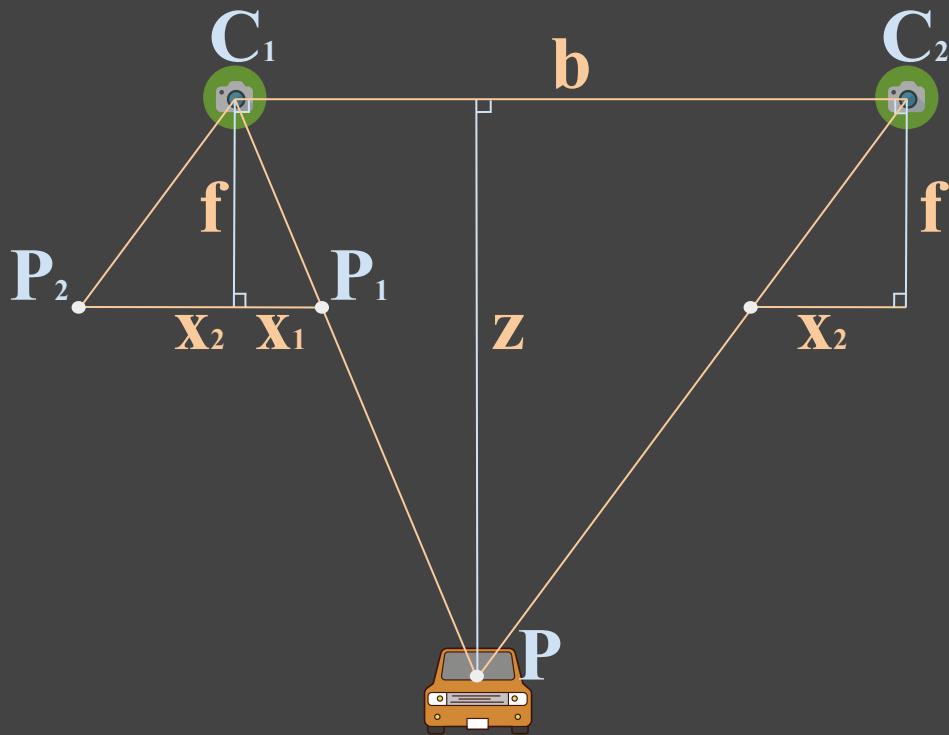
Let's Do Geometry!



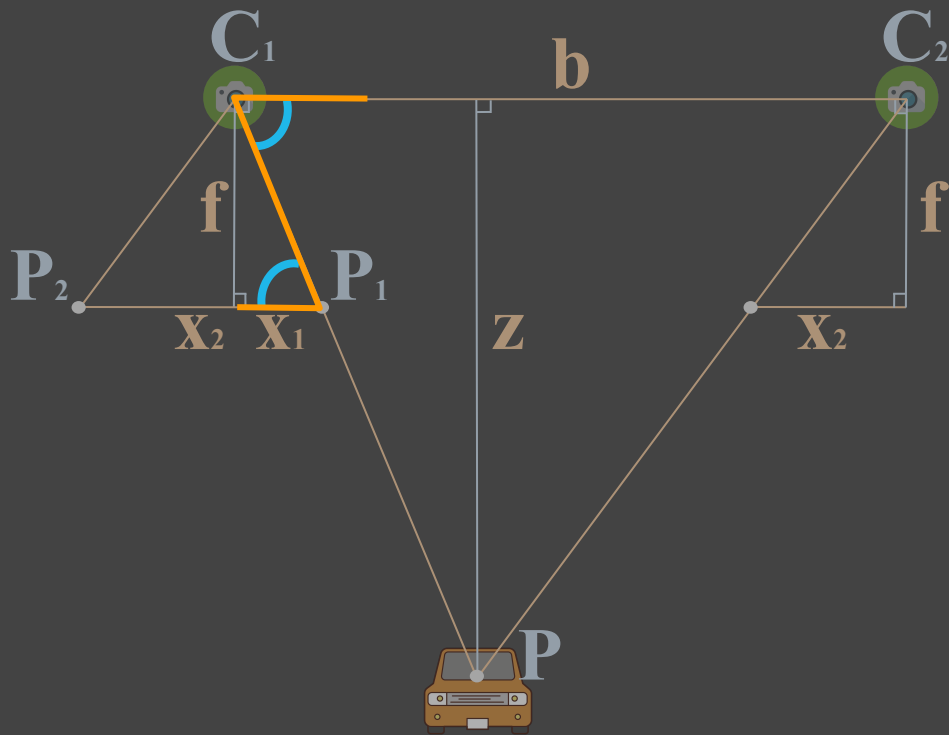
Let's Do Geometry!



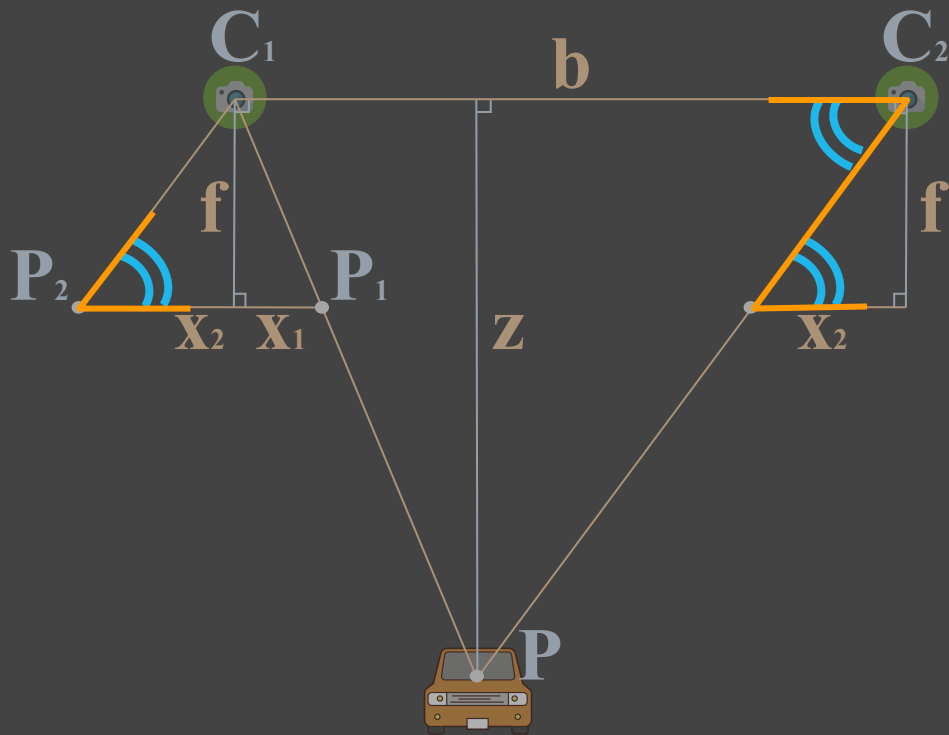
Let's Do Geometry!



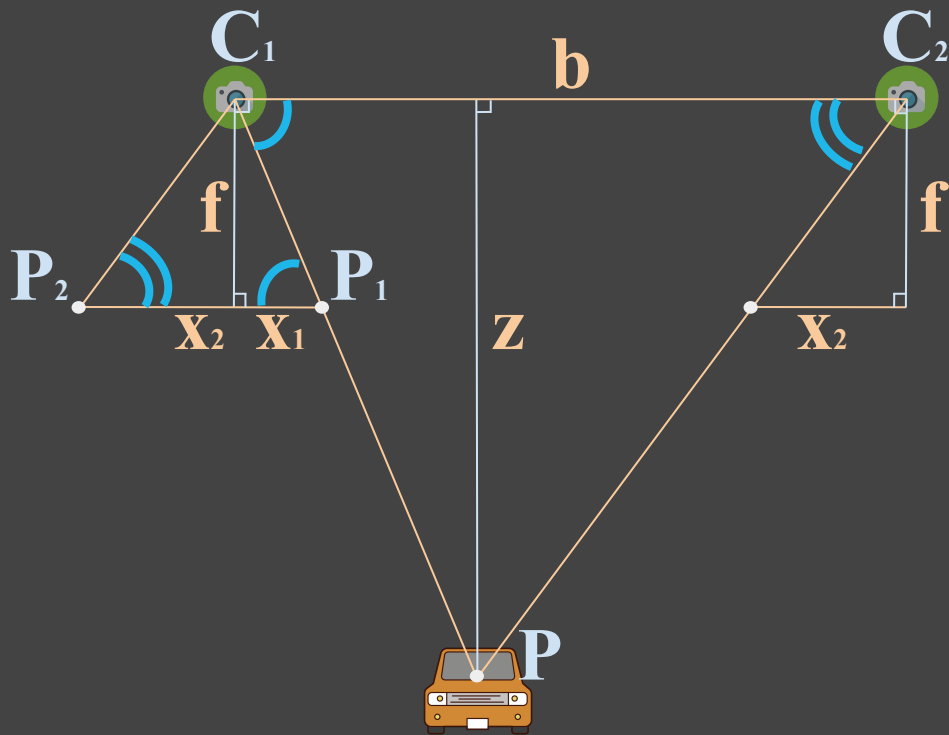
Let's Do Geometry!



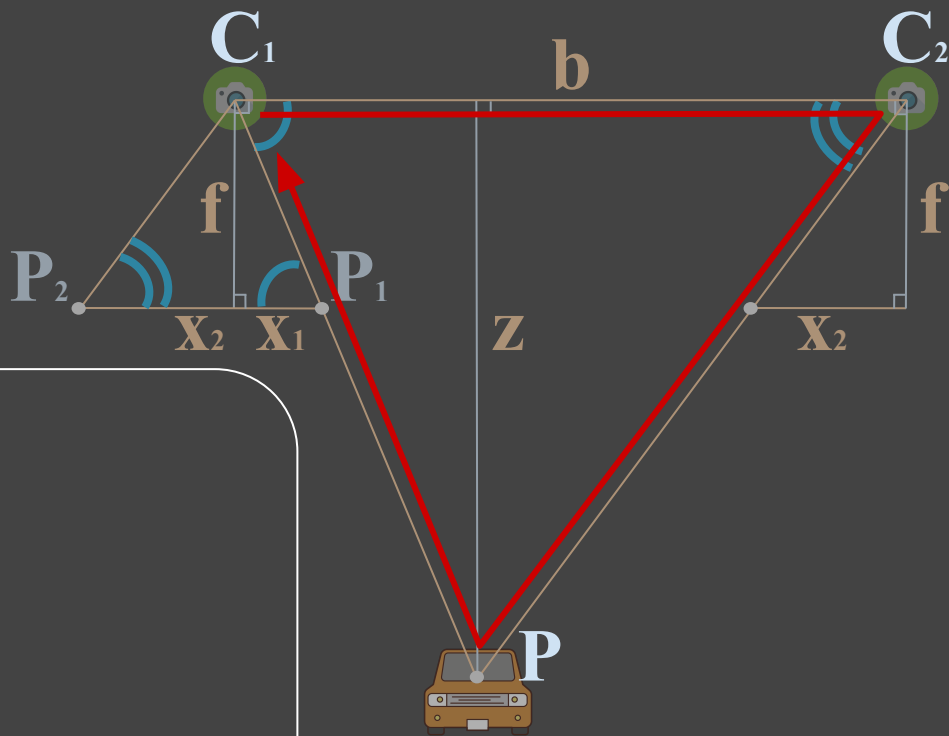
Let's Do Geometry!



Let's Do Geometry!

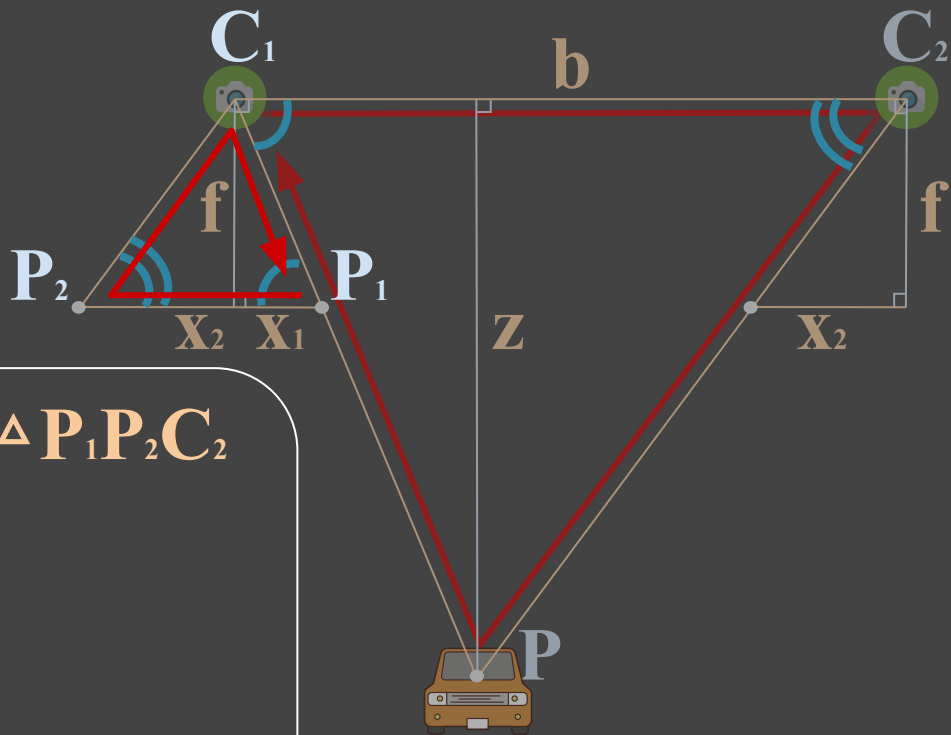


Let's Do Geometry!



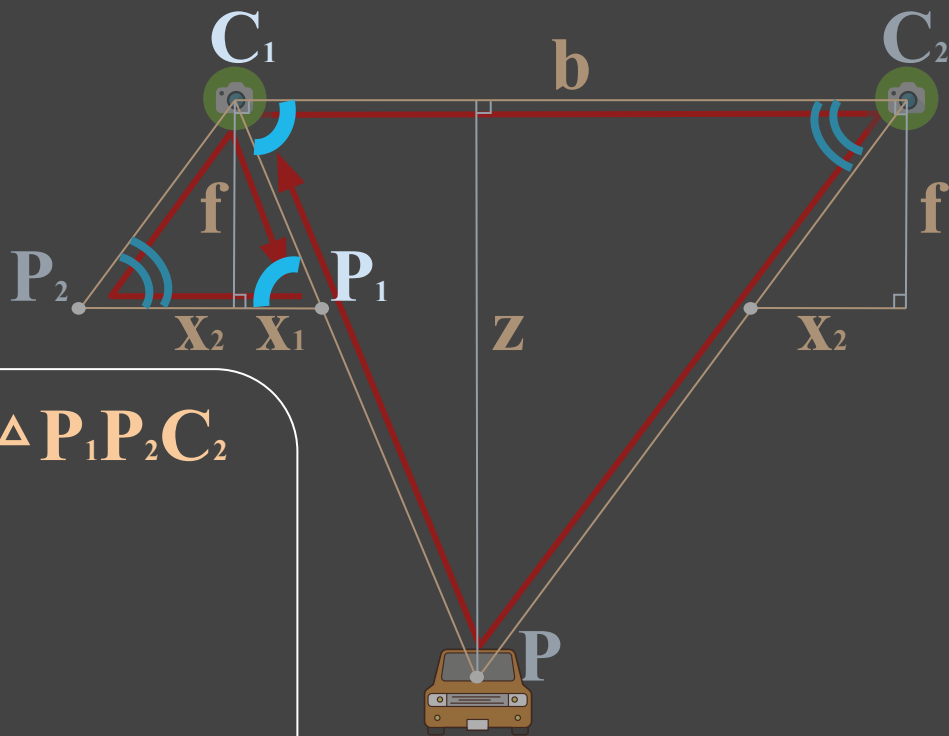
$\Delta C_1 C_2 P$

Let's Do Geometry!



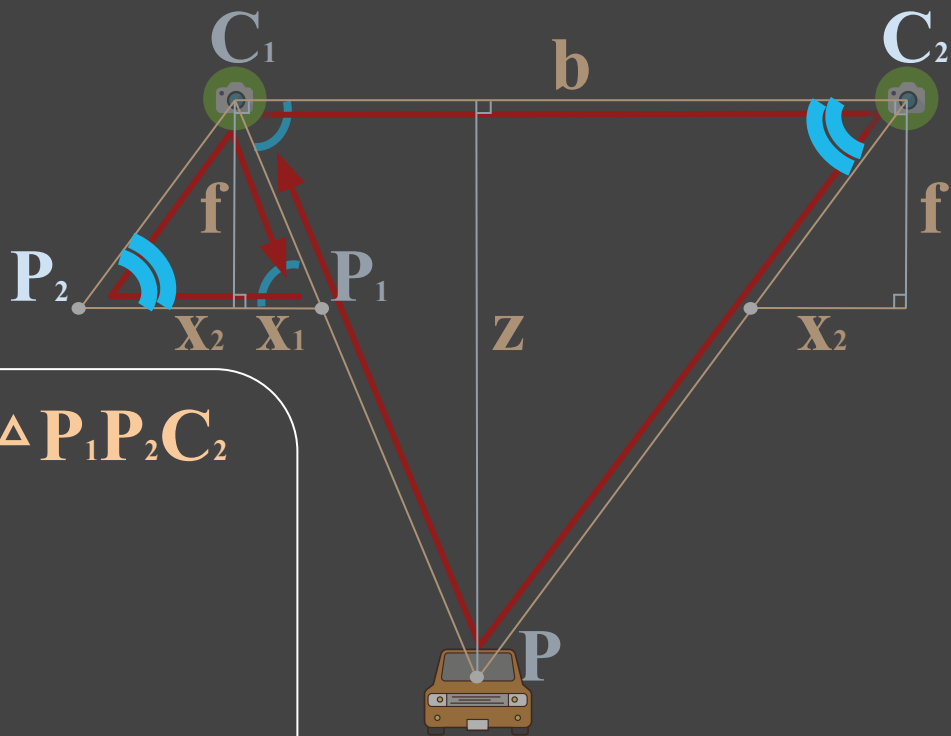
$$\triangle C_1 C_2 P \approx \triangle P_1 P_2 C_2$$

Let's Do Geometry!



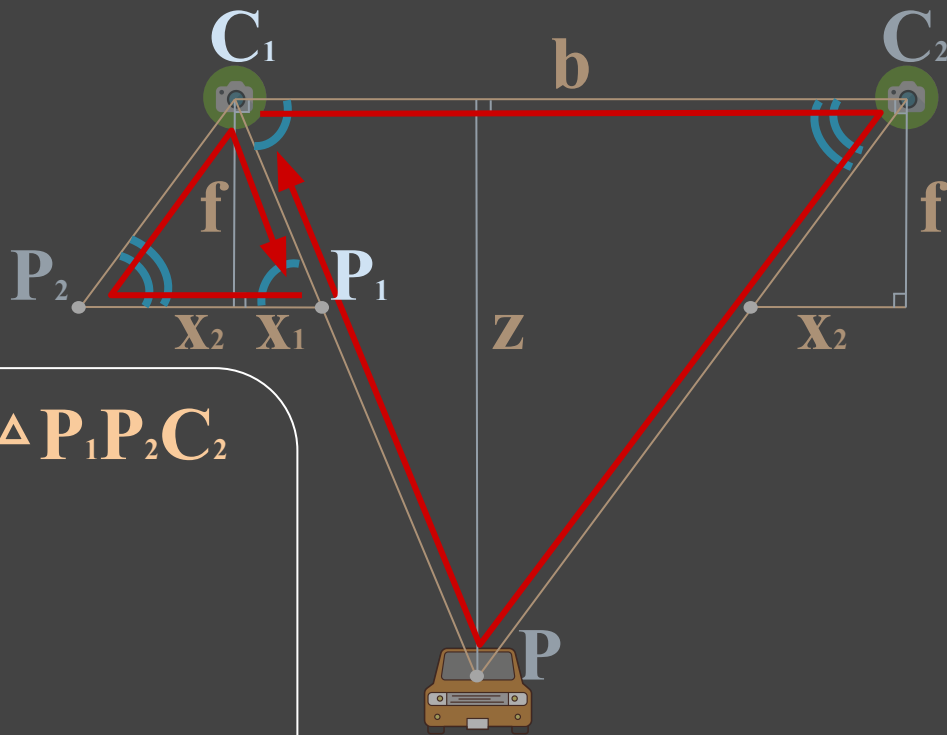
$$\triangle C_1 C_2 P \approx \triangle P_1 P_2 C_2$$

Let's Do Geometry!



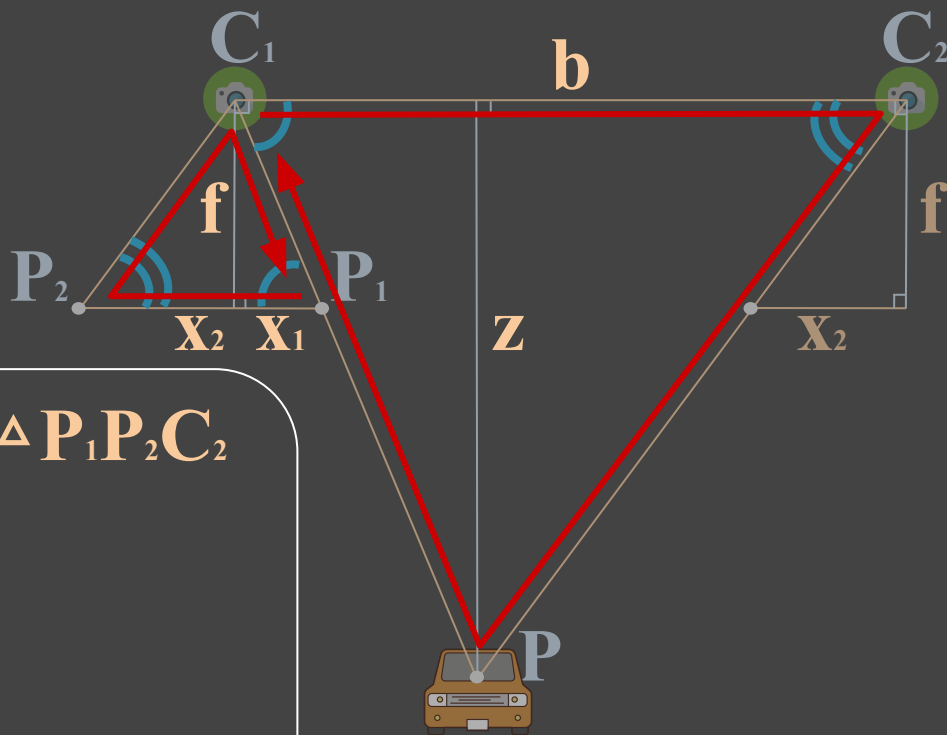
$$\triangle C_1 C_2 P \approx \triangle P_1 P_2 C_2$$

Let's Do Geometry!



$$\triangle C_1 C_2 P \approx \triangle P_1 P_2 C_2$$

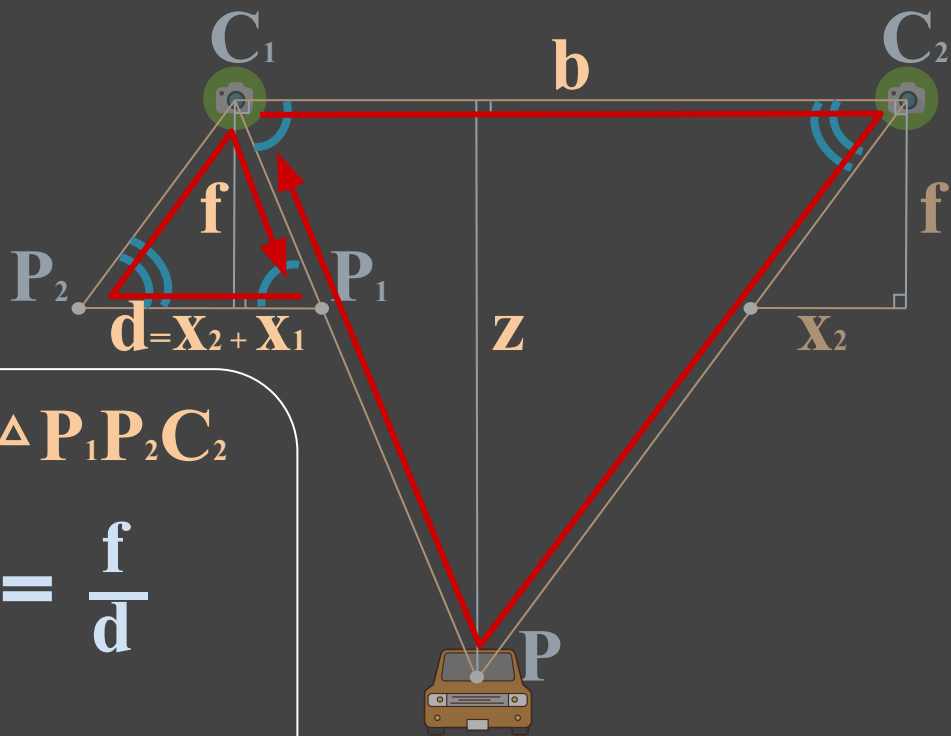
Let's Do Geometry!



$$\triangle C_1 C_2 P \approx \triangle P_1 P_2 C_2$$

$$\frac{z}{b} = \frac{f}{x_1 + x_2}$$

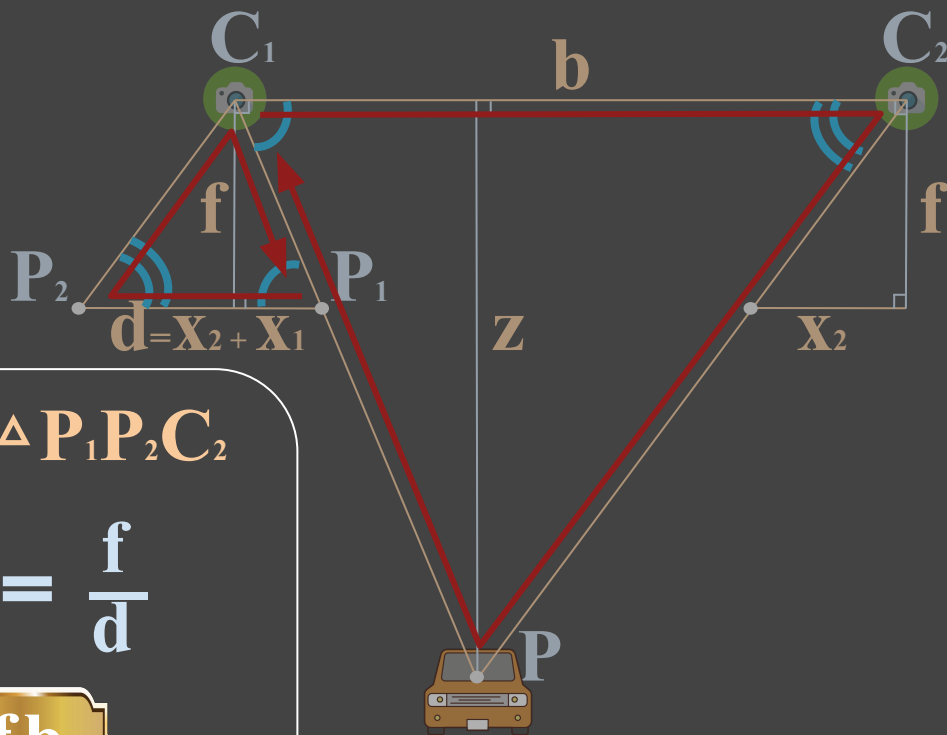
Let's Do Geometry!



$$\triangle C_1 C_2 P \approx \triangle P_1 P_2 C_2$$

$$\frac{z}{b} = \frac{f}{x_1 + x_2} = \frac{f}{d}$$

Let's Do Geometry!

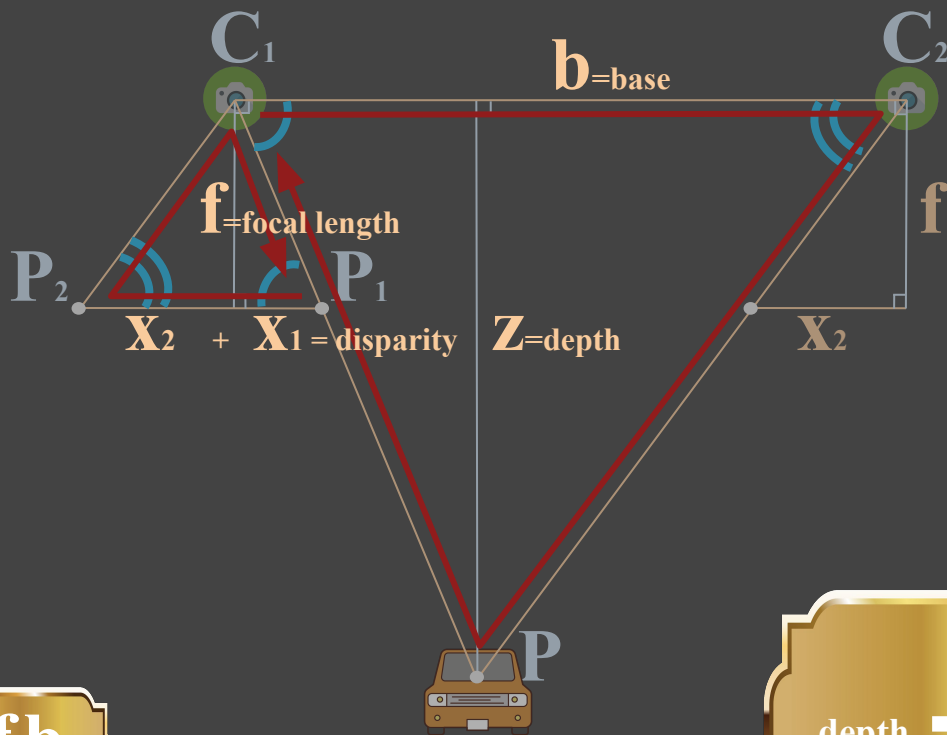


$$\triangle C_1 C_2 P \approx \triangle P_1 P_2 C_2$$

$$\frac{z}{b} = \frac{f}{x_1 + x_2} = \frac{f}{d}$$

$$z = \frac{fb}{d}$$

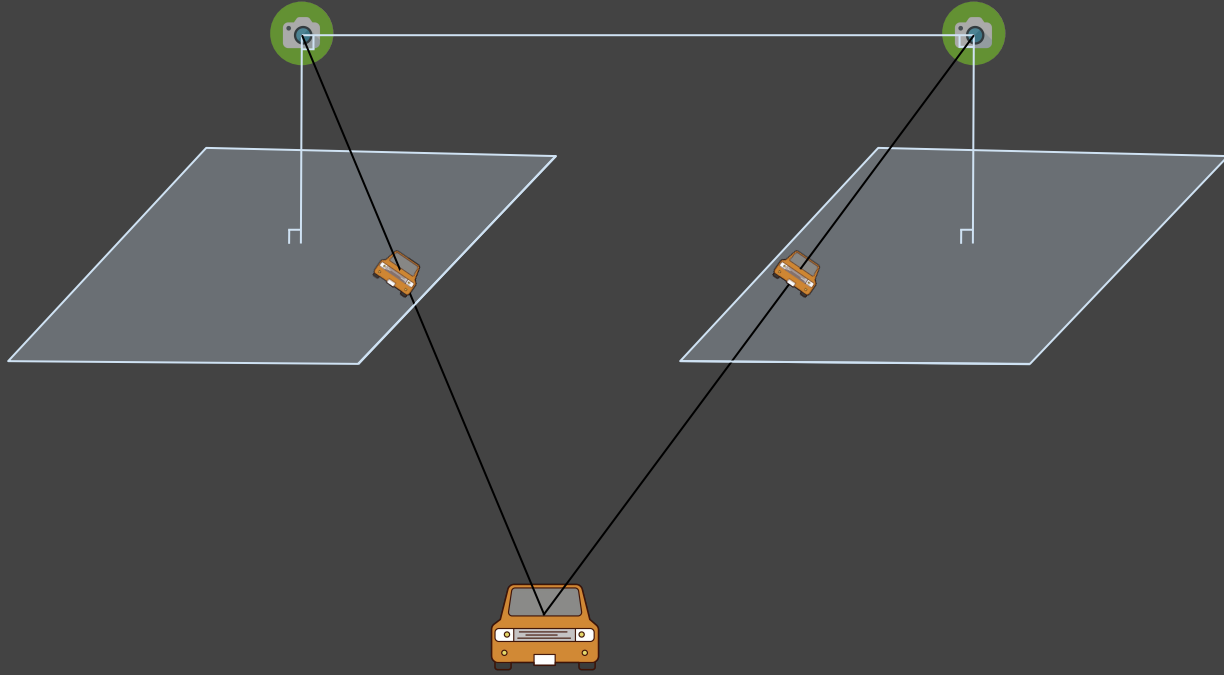
Let's Do Geometry!



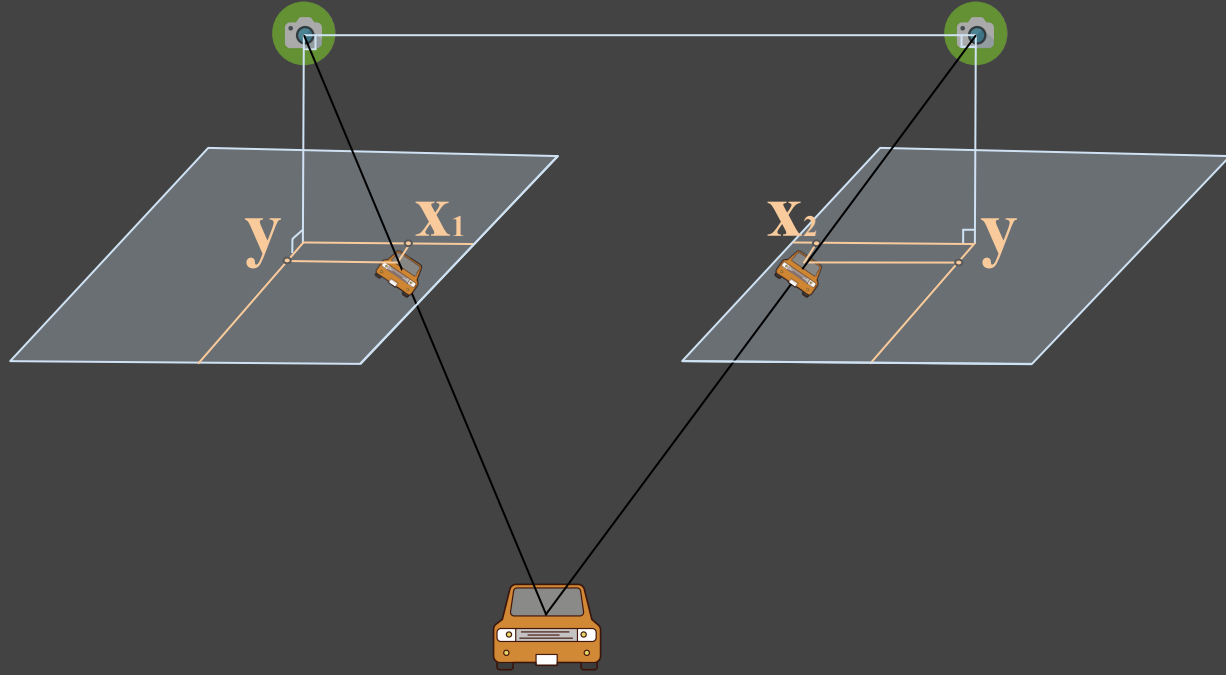
$$z = \frac{fb}{d}$$

$$\text{depth} = \frac{\text{base} * \text{focal length}}{\text{disparity}}$$

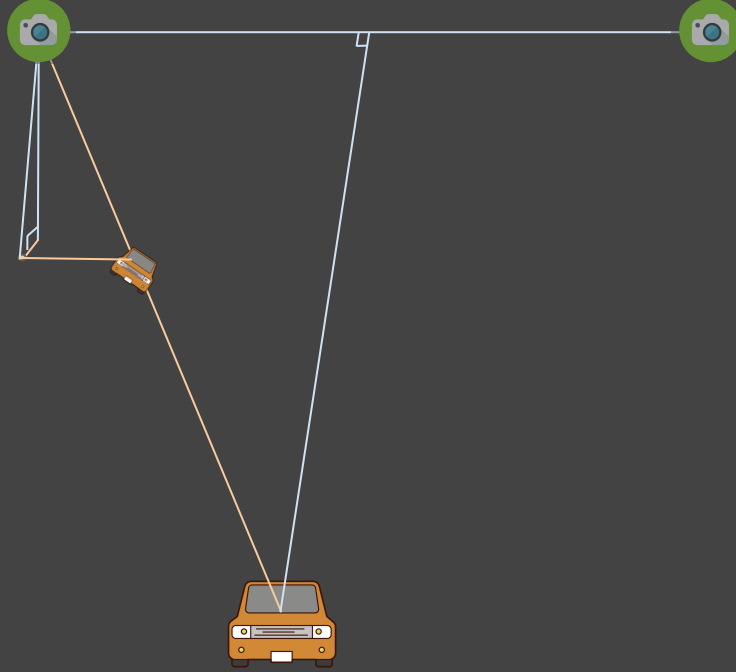
Stereo Vision



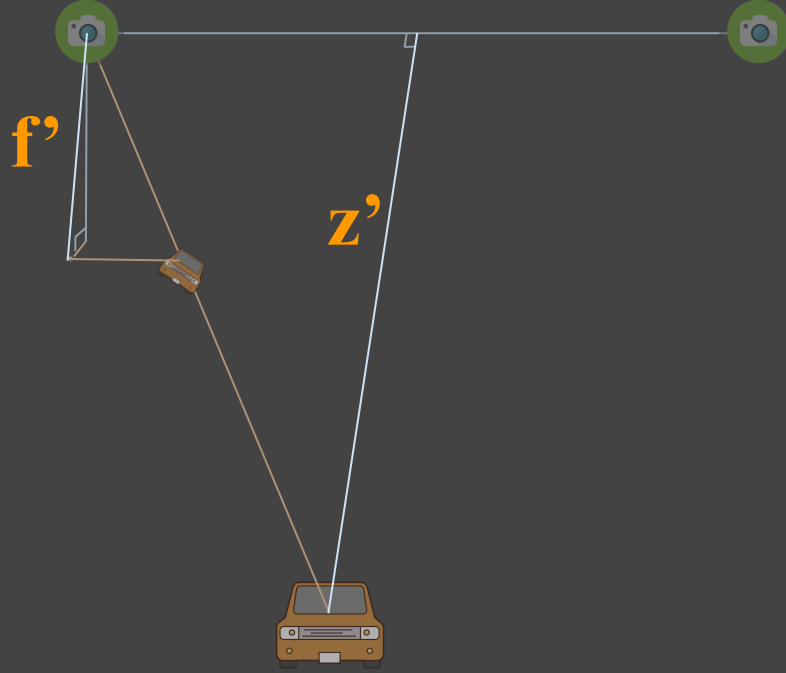
Let's Do Geometry!



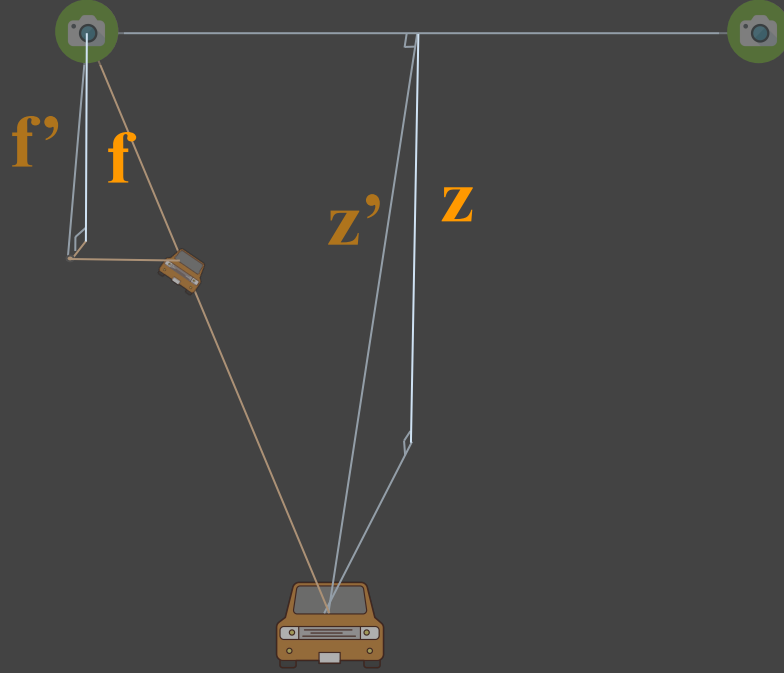
Let's Do Geometry!



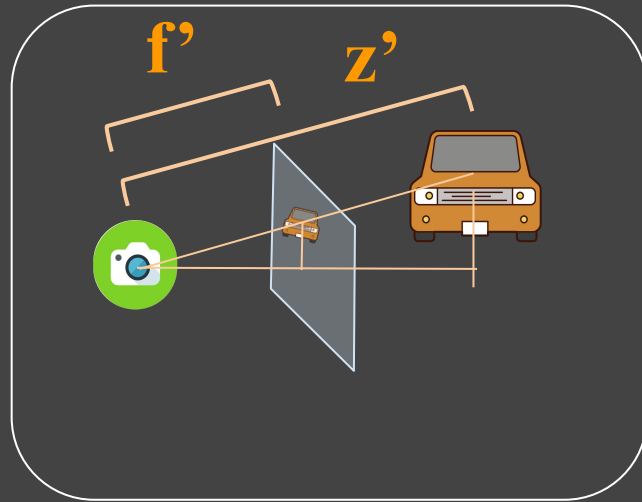
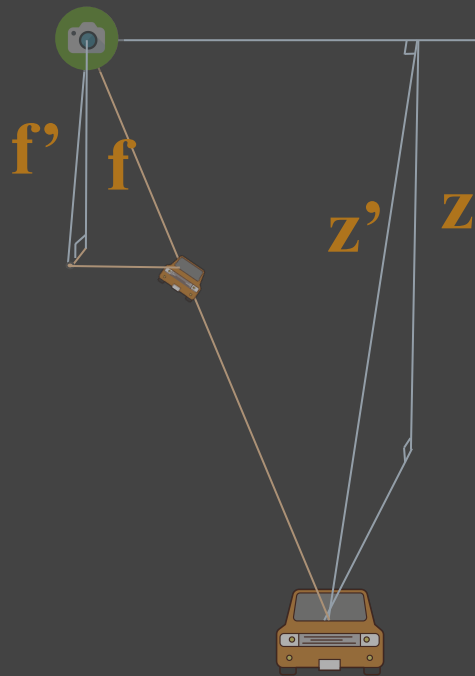
Let's Do Geometry!



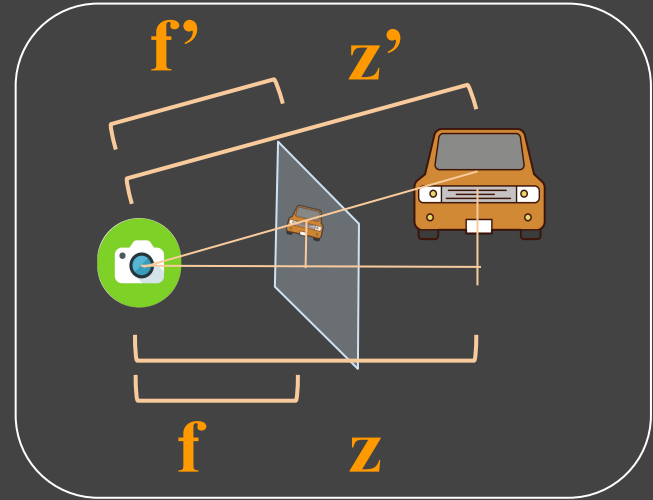
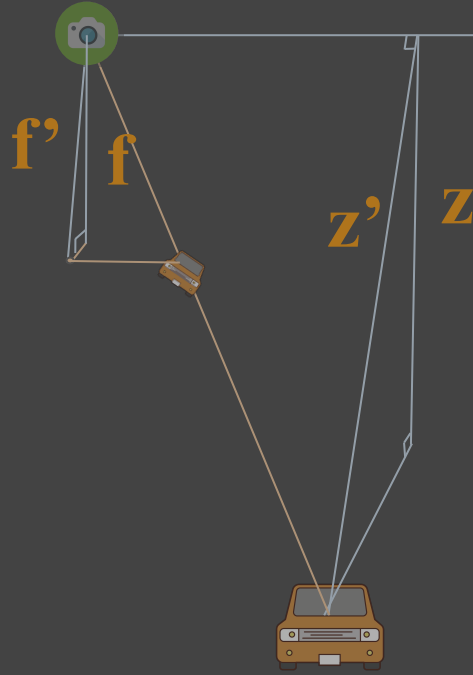
Let's Do Geometry!



Let's Do Geometry!

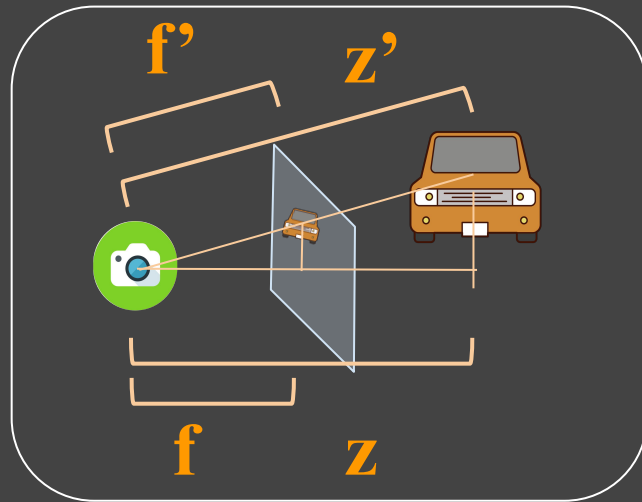
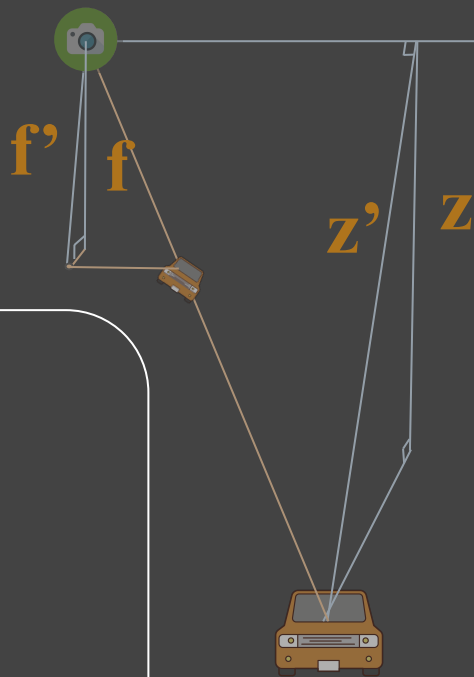


Let's Do Geometry!

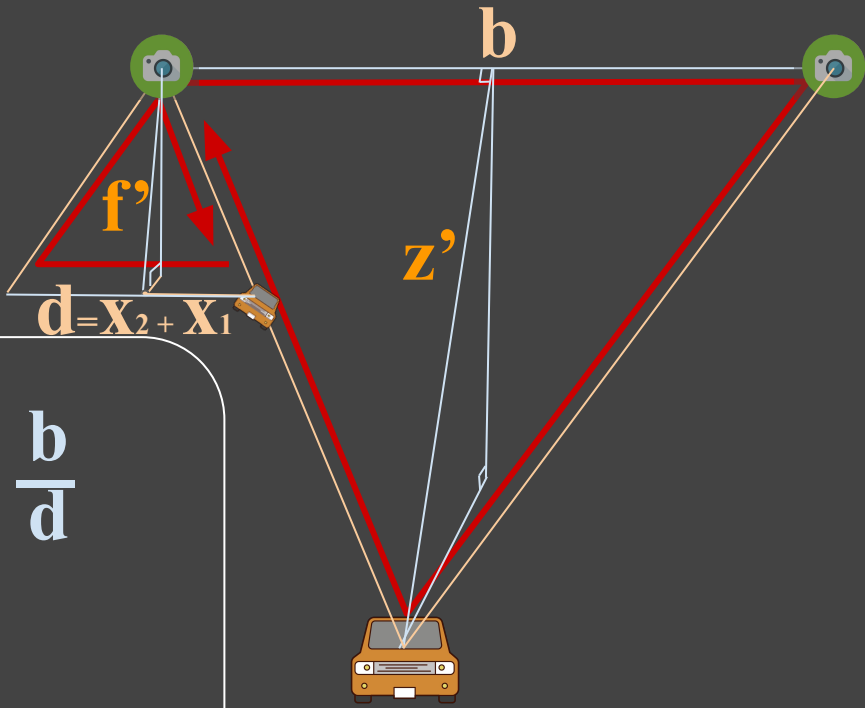


Let's Do Geometry!

$$\frac{z}{f} = \frac{z'}{f'}$$

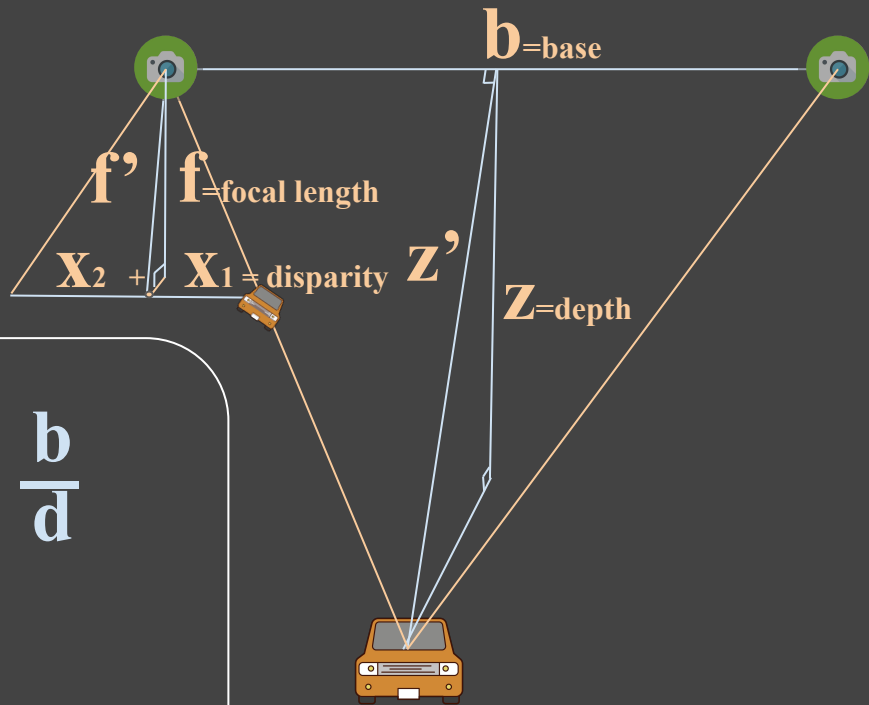


Let's Do Geometry!



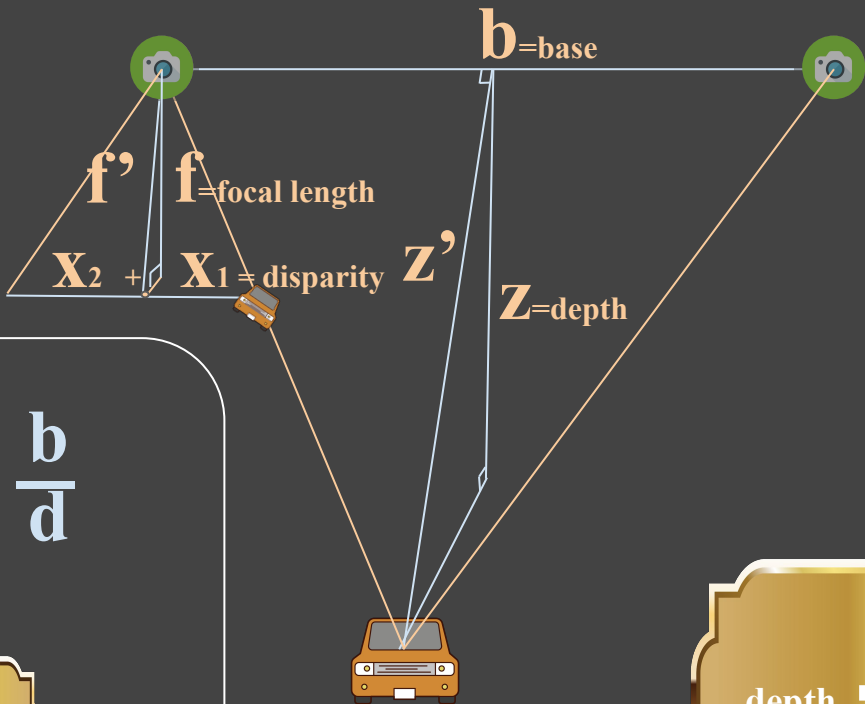
$$\frac{z'}{f'} = \frac{b}{d}$$

Let's Do Geometry!



$$\frac{z}{f} = \frac{z'}{f'} = \frac{b}{d}$$

Let's Do Geometry!



$$\frac{z}{f} = \frac{z'}{f'} = \frac{b}{d}$$

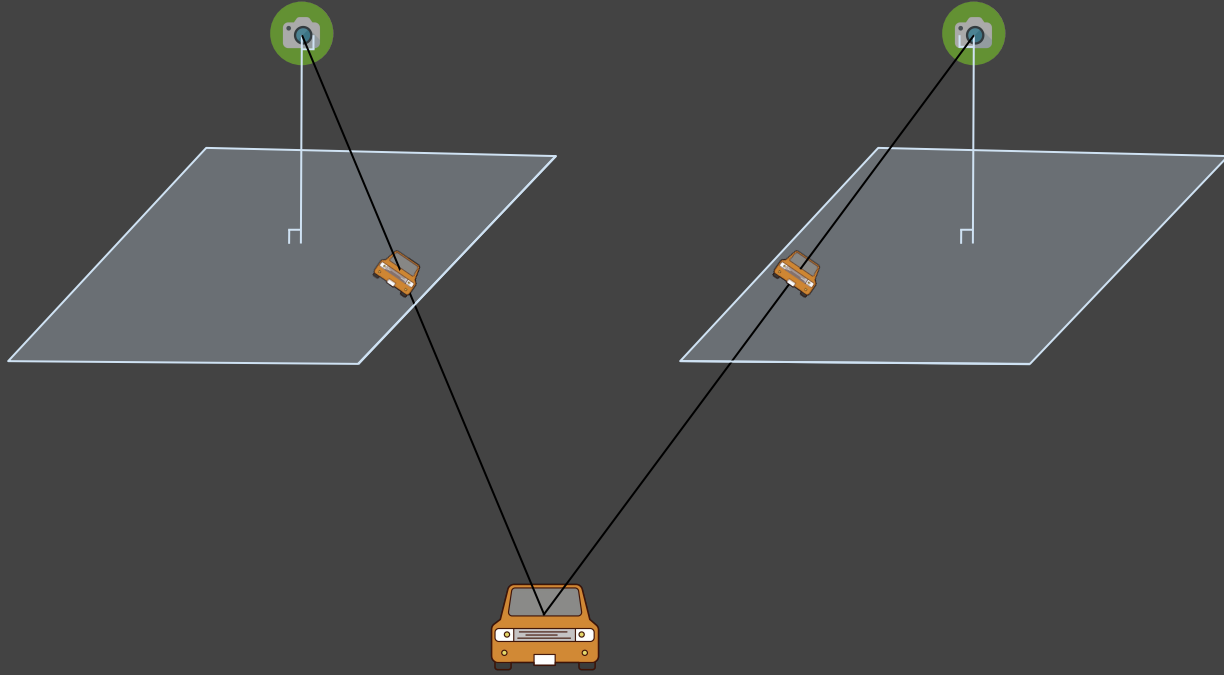
$$z = \frac{fb}{d}$$

$$\text{depth} = \frac{\text{base} * \text{focal length}}{\text{disparity}}$$

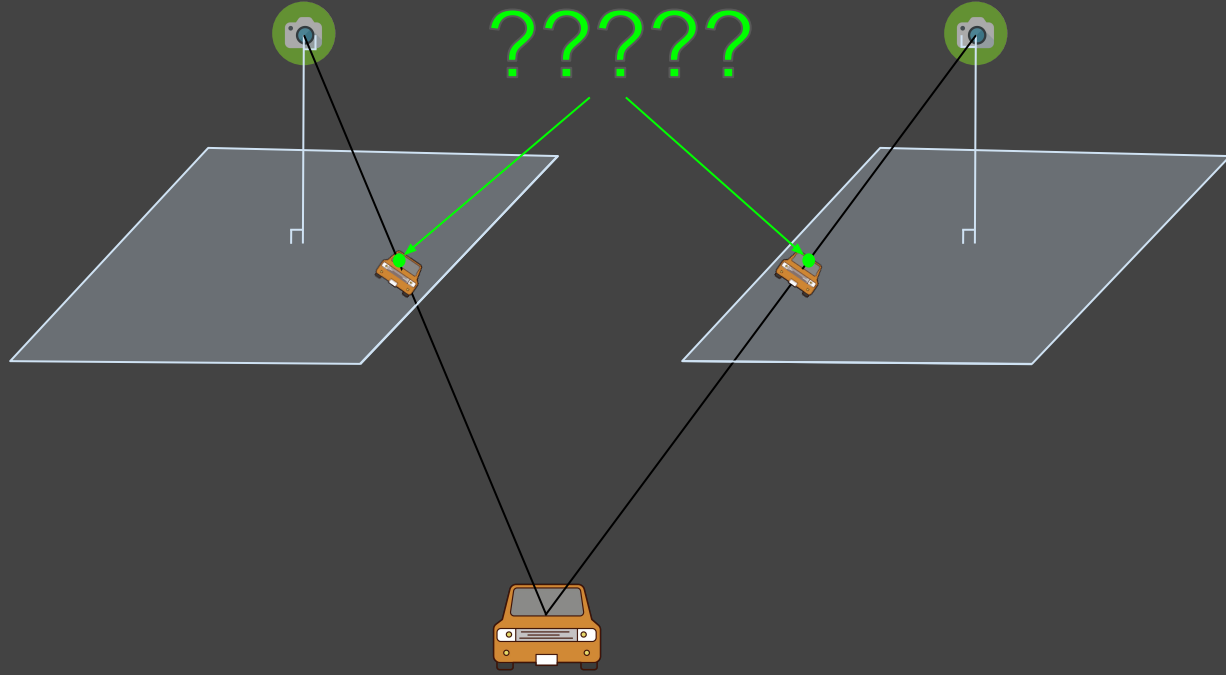
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- ☑ Laying Foundations
- ☑ Geometry!

Stereo Vision



Stereo Vision



Thank you :)

Questions?

Dalya Gartzman

bit.ly/DepthAndDisparity