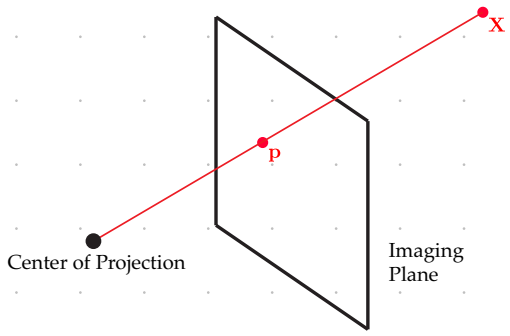
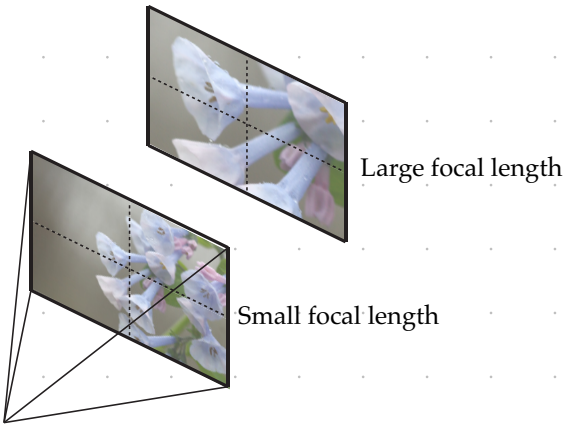
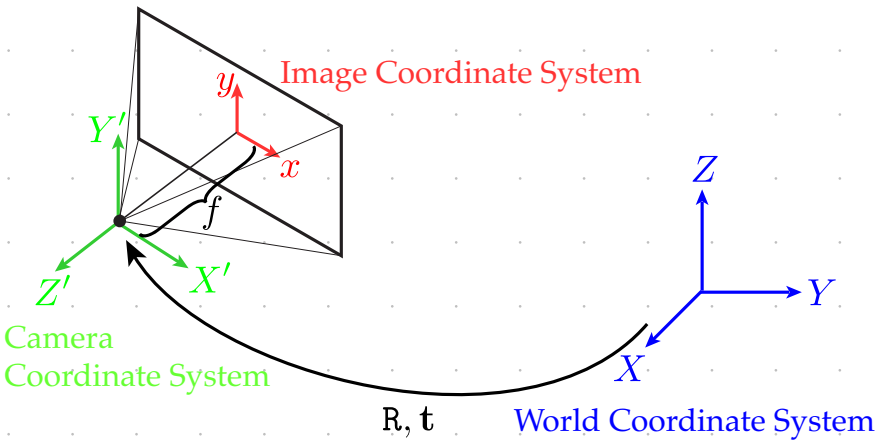
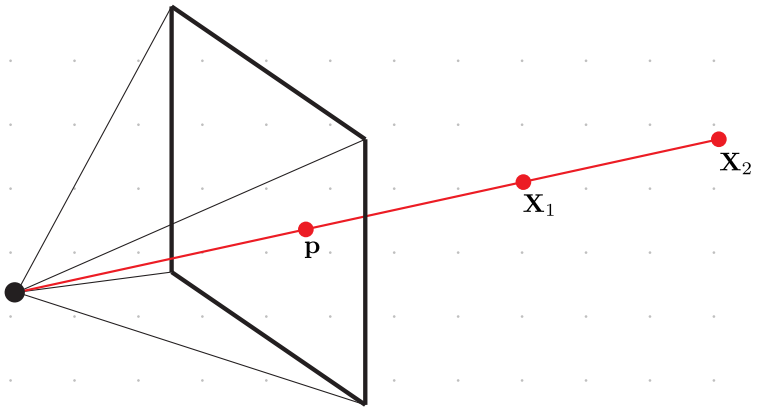
Motivating Video: SfM

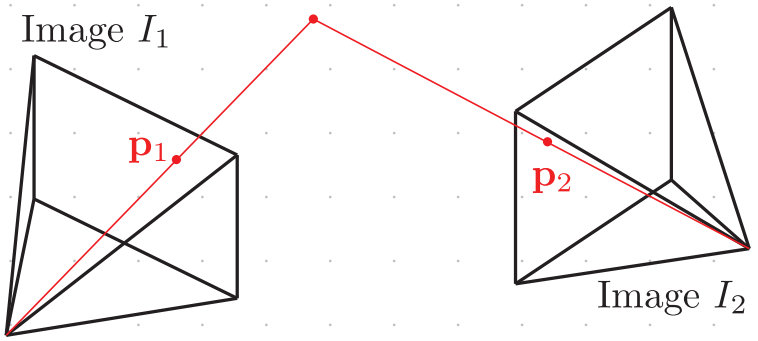






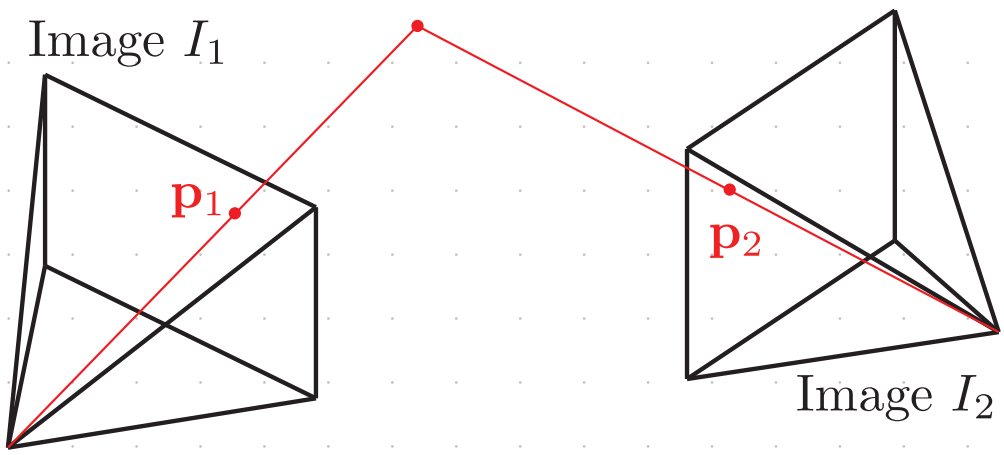
Projection is Lossy





Digression: Math is Hard.

Triangulation



Knowns:

Unknowns:

Goal:

Write an optimization problem:

Sketch out how to solve this:

Variants:

Camera Calibration (Resectioning)

Figure 39.7 from Torralba, A., Isola, P., & Freeman, W.T. (2024). *Foundations of Computer Vision.* MIT Press. `https://visionbook.mit.edu/` (CC-BY-NC-ND)

Knowns:

Unknowns:

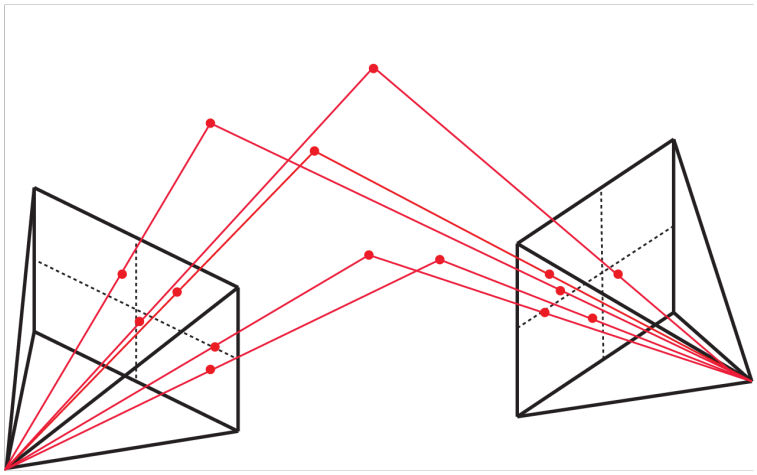
Goal:

Write an optimization problem:

Sketch out how to solve this:

- Perspective-3-Point (P3P) algorithm – Link to code
- Direct Linear Transform (DLT) – cover in a few weeks.
- Non-linear optimization (Bundle Adjustment)

Two-View Modeling



Knowns:

Unknowns:

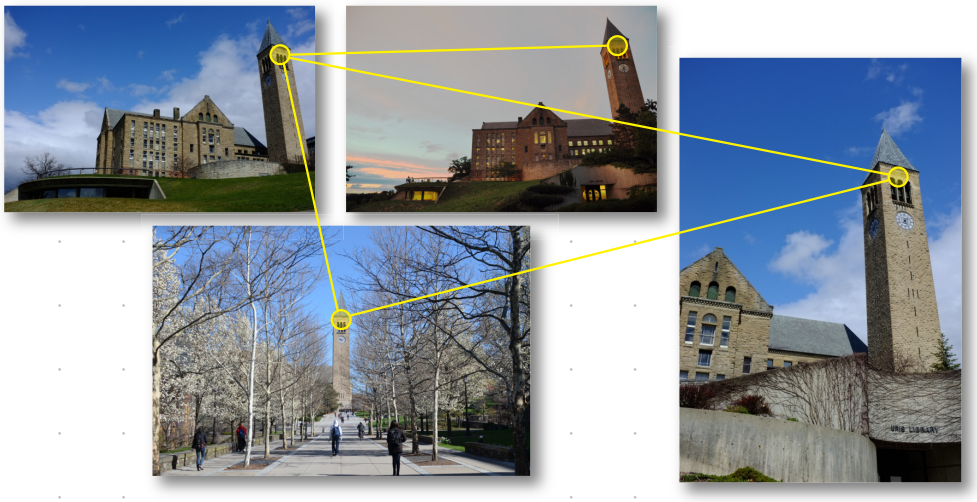
Goal:

Write an optimization problem:

Sketch out how to solve this:

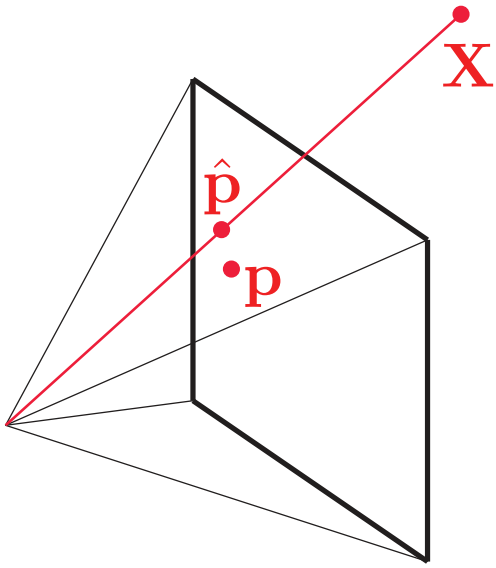
- Nister's 5-point algorithm
- Direct Linear Transform (DLT) – cover in a few weeks.
- Non-linear optimization (Bundle Adjustment)

Structure from Motion (SfM)



Video: Structure from Motion reconstruction of the old city of Dubrovnik.

Bundle Adjustment



Knowns:

Unknowns:

Goal:

Write an optimization problem:

Sketch out how to solve this:

- Ceres Solver