Uncalibrated Stereo

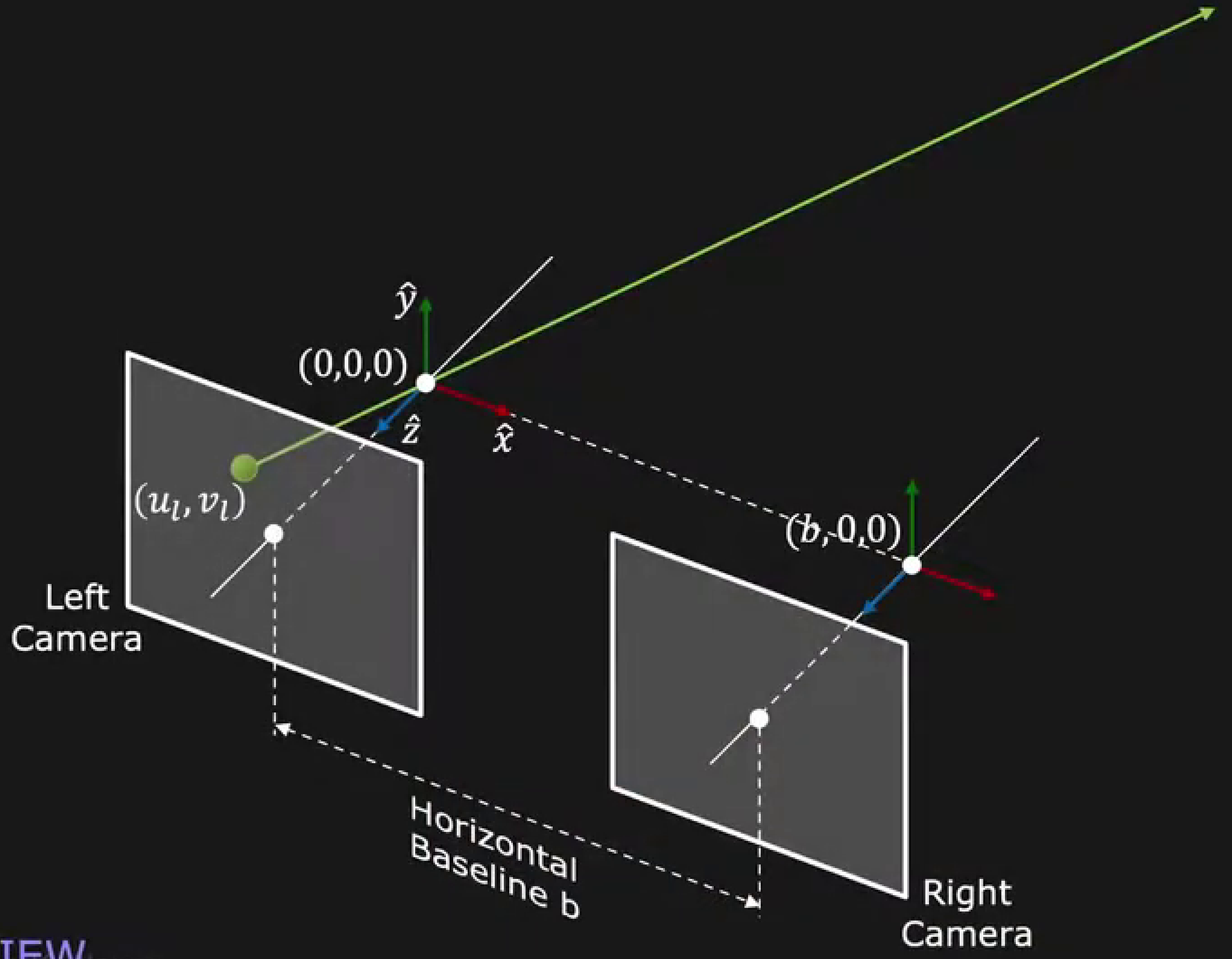
Shree K. Nayar

Columbia University

Topic: Uncalibrated Stereo, Module: Reconstruction II

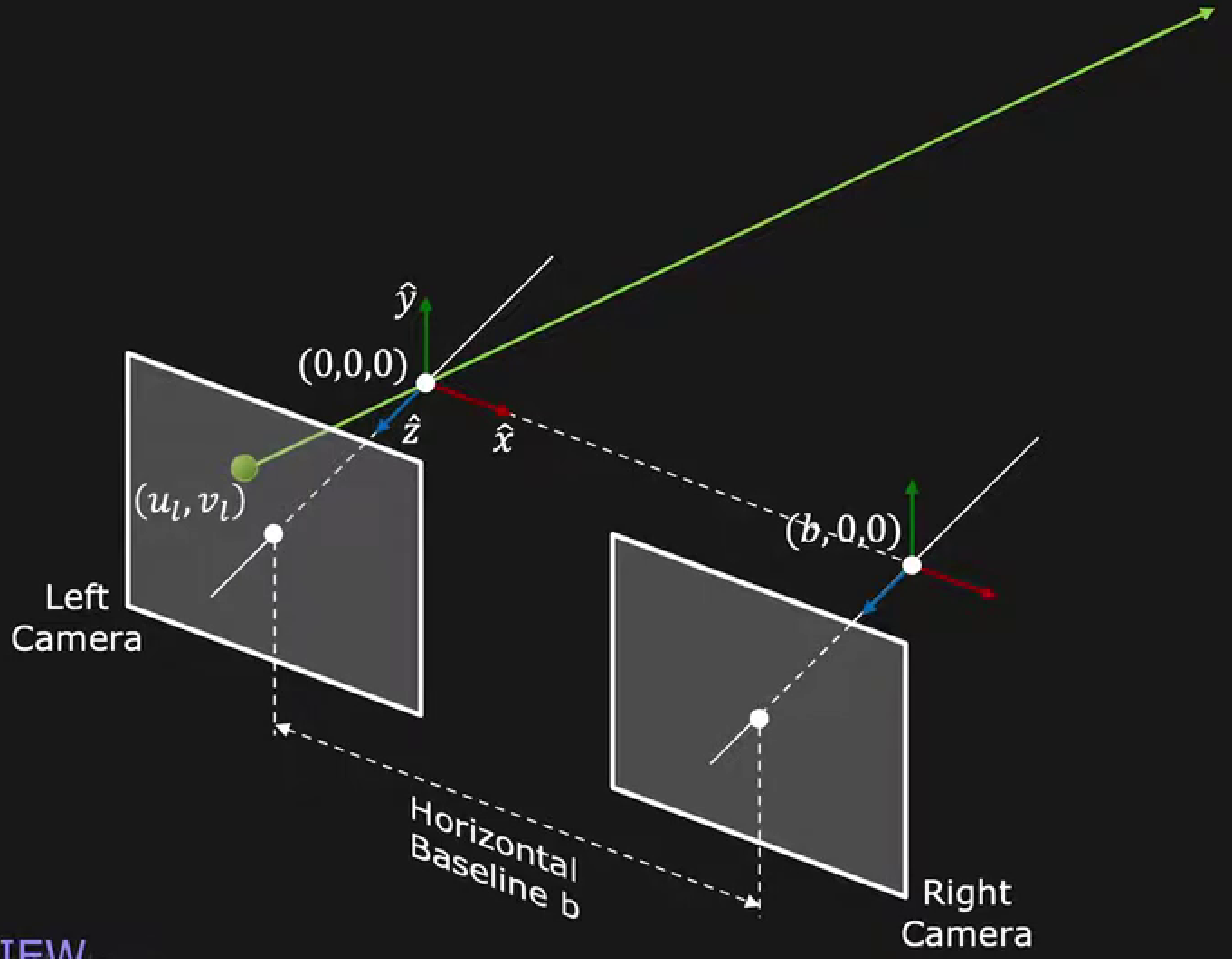
First Principles of Computer Vision

Simple (Calibrated) Stereo



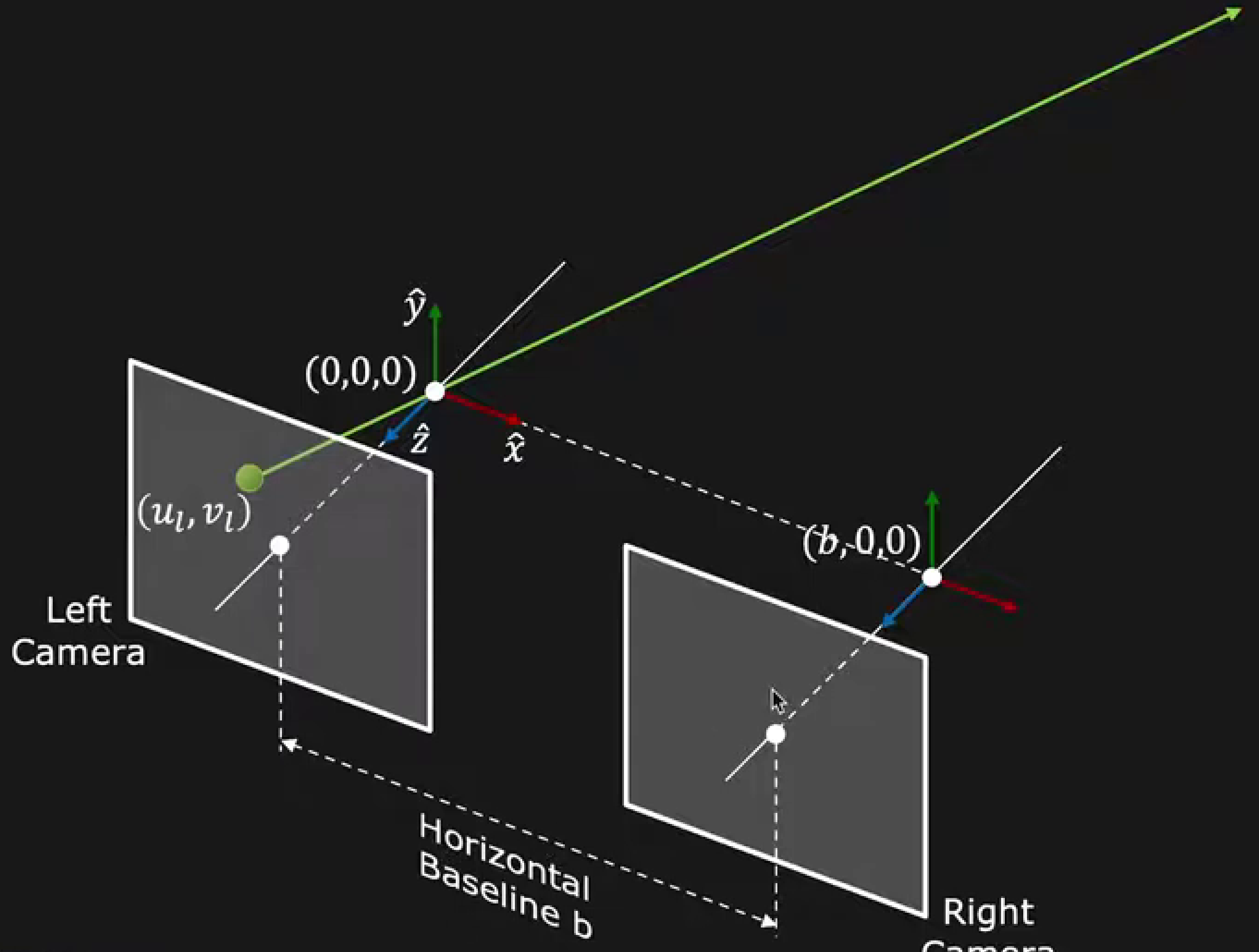
REVIEW

Simple (Calibrated) Stereo



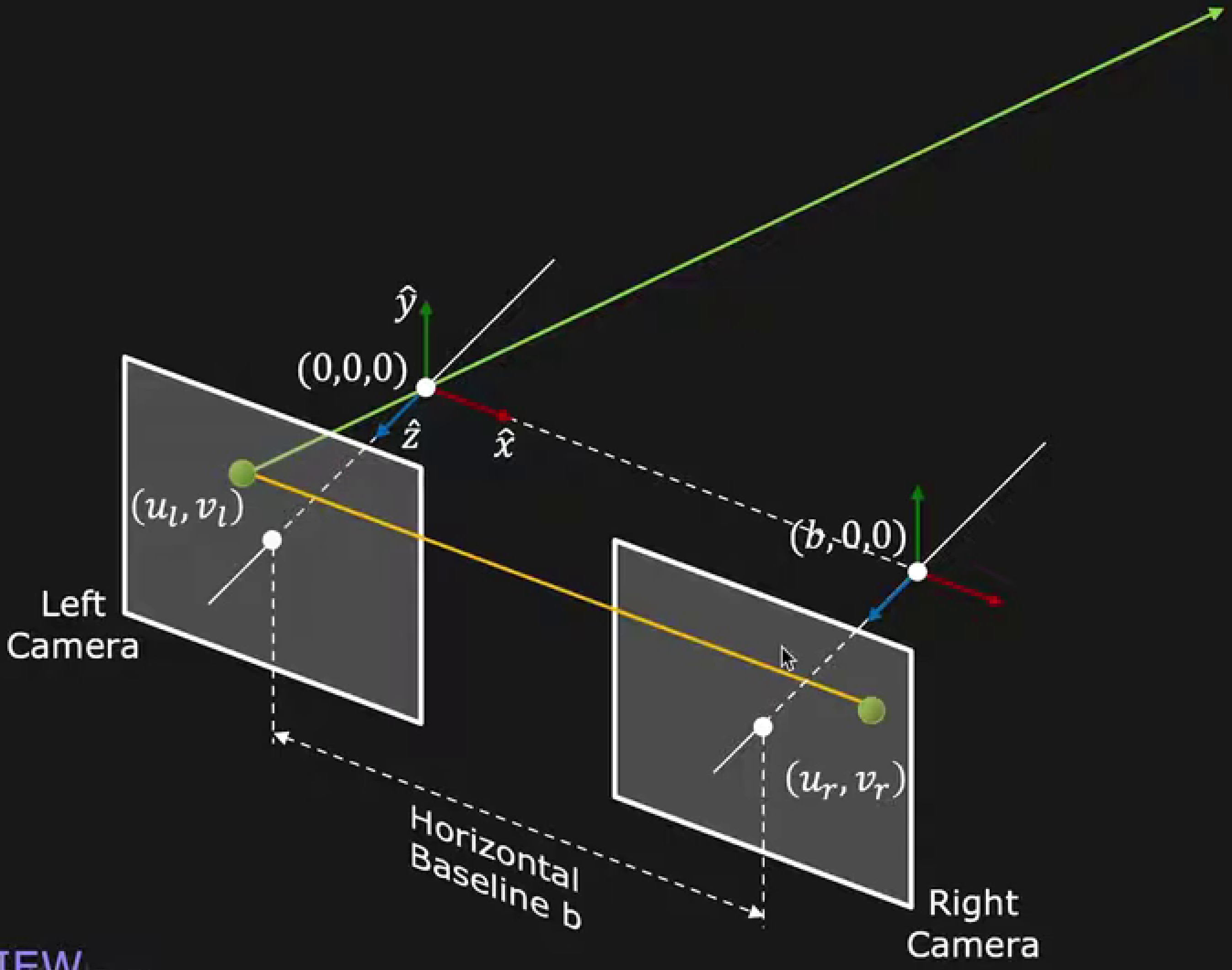
REVIEW

Simple (Calibrated) Stereo



REVIEW

Simple (Calibrated) Stereo

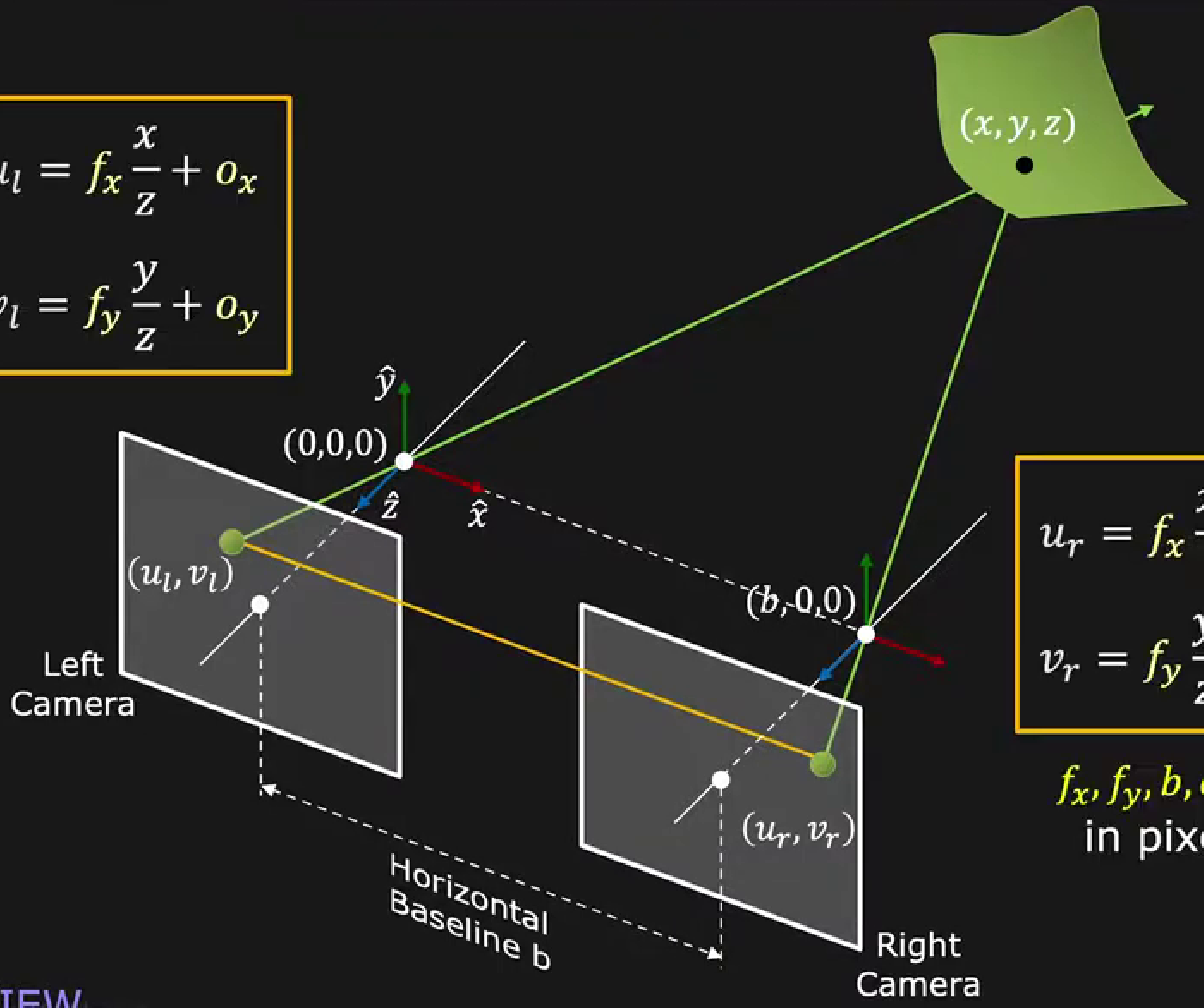


REVIEW

Simple (Calibrated) Stereo

$$u_l = f_x \frac{x}{z} + o_x$$

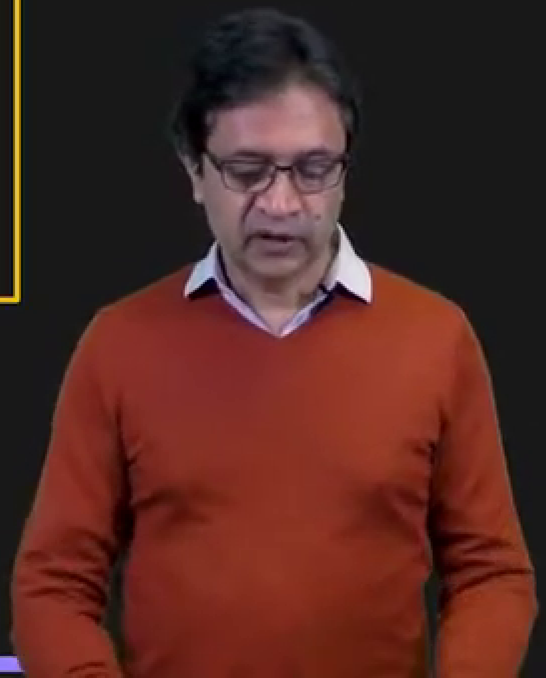
$$v_l = f_y \frac{y}{z} + o_y$$



$$u_r = f_x \frac{x - b}{z} + o_x$$

$$v_r = f_y \frac{y}{z} + o_y$$

f_x, f_y, b, o_x, o_y are in pixel units.

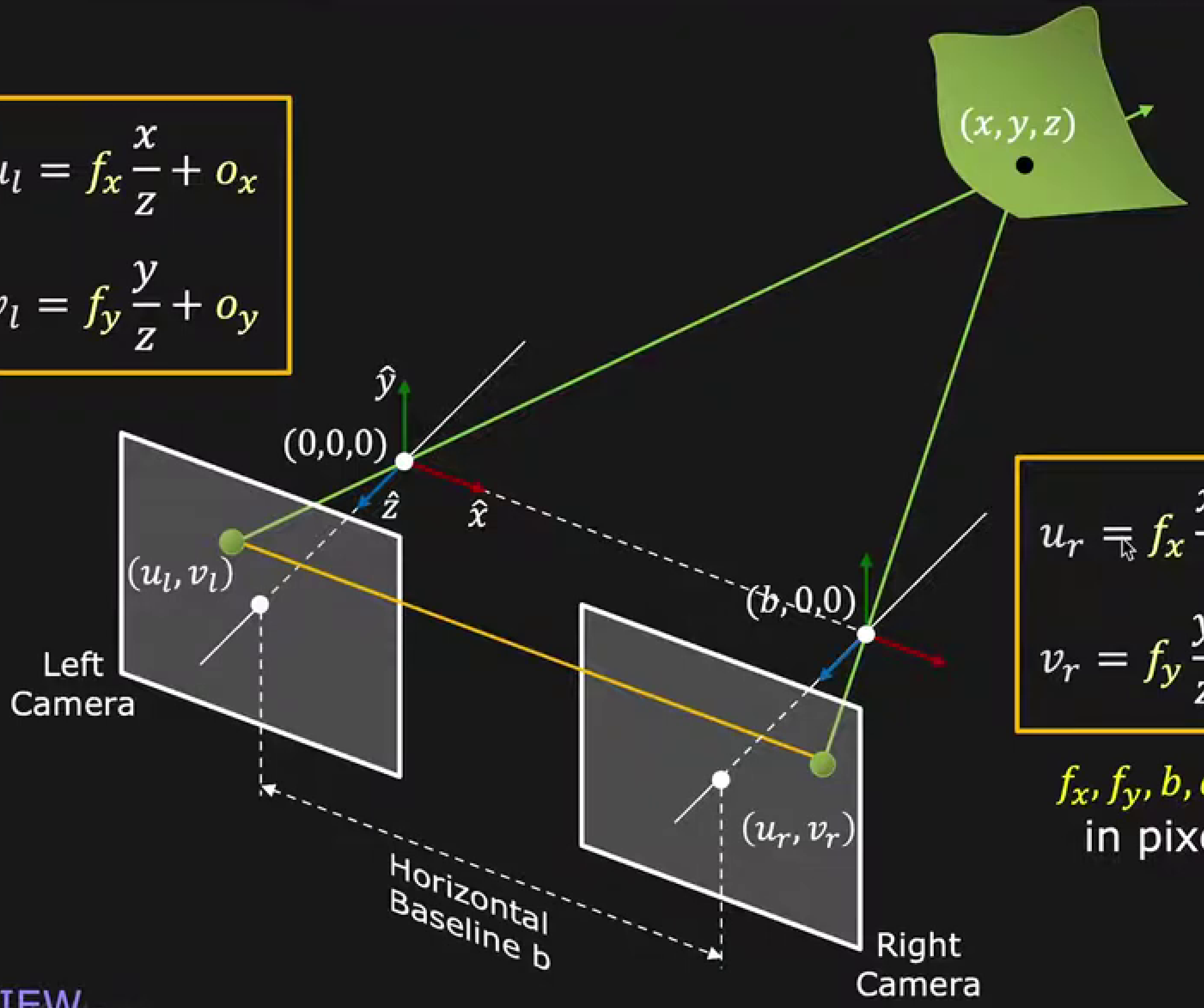


REVIEW

Simple (Calibrated) Stereo

$$u_l = f_x \frac{x}{z} + o_x$$

$$v_l = f_y \frac{y}{z} + o_y$$



$$u_r = f_x \frac{x - b}{z} + o_x$$

$$v_r = f_y \frac{y}{z} + o_y$$

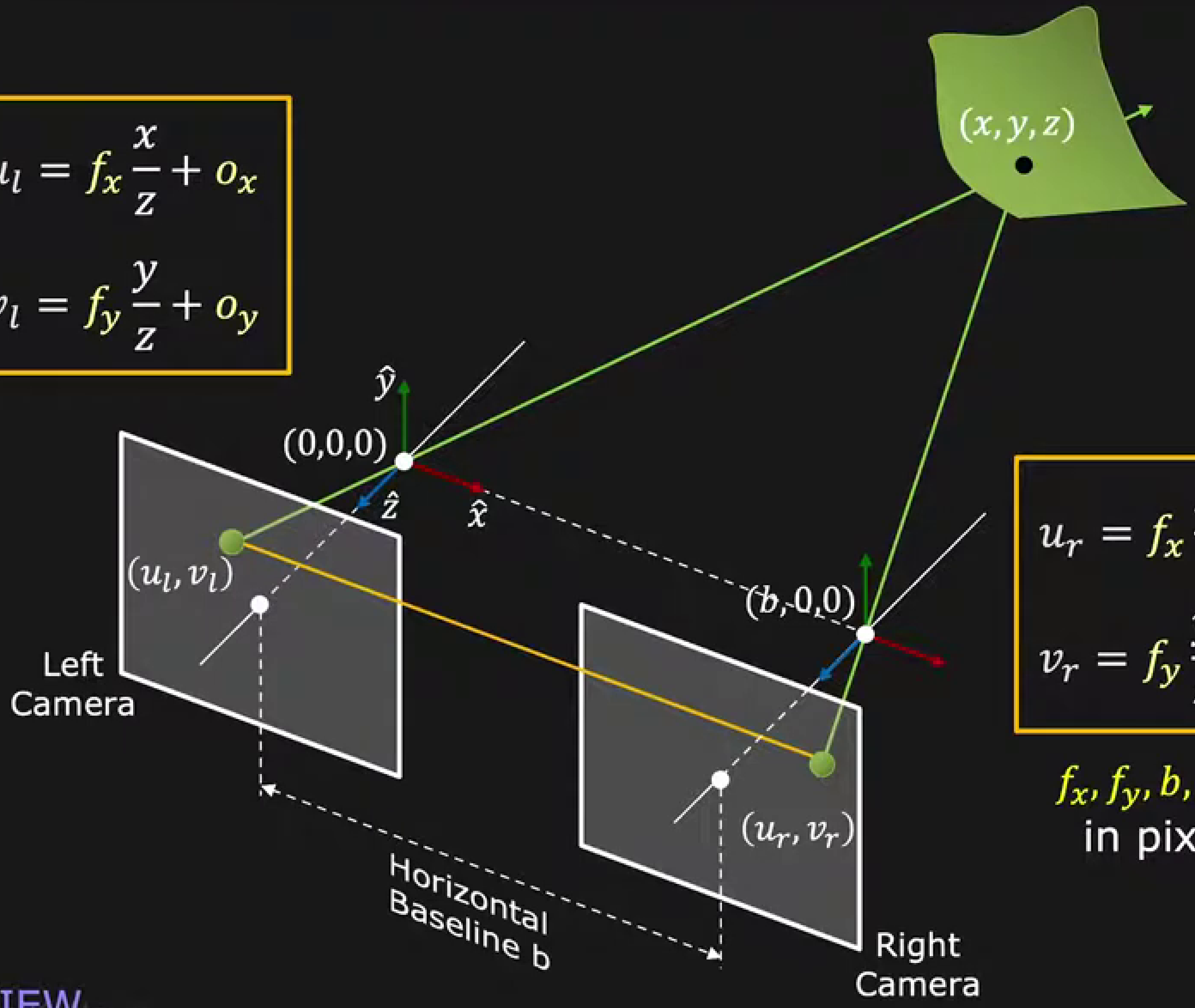
f_x, f_y, b, o_x, o_y are in pixel units.

REVIEW

Simple (Calibrated) Stereo

$$u_l = f_x \frac{x}{z} + o_x$$

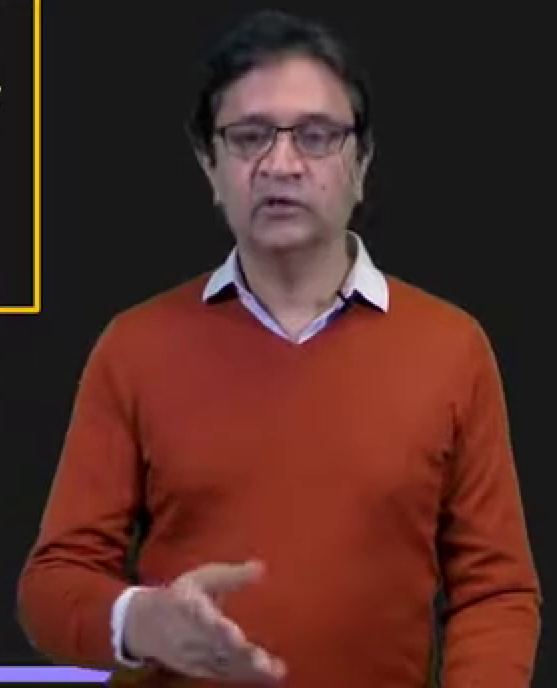
$$v_l = f_y \frac{y}{z} + o_y$$



$$u_r = f_x \frac{x - b}{z} + o_x$$

$$v_r = f_y \frac{y}{z} + o_y$$

f_x, f_y, b, o_x, o_y are in pixel units.



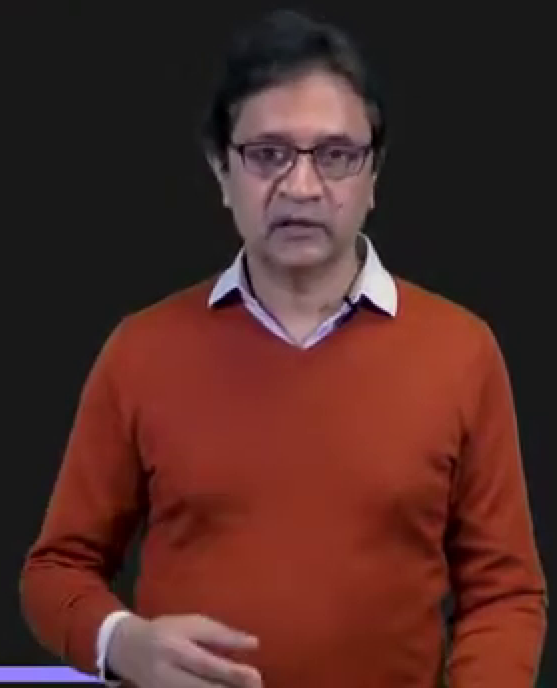
REVIEW

Depth and Disparity

Solving for (x, y, z):

$$x = \frac{b(u_l - o_x)}{(u_l - u_r)} \qquad y = \frac{bf_x(v_l - o_y)}{f_y(u_l - u_r)} \qquad \boxed{z = \frac{bf_x}{(u_l - u_r)}}$$

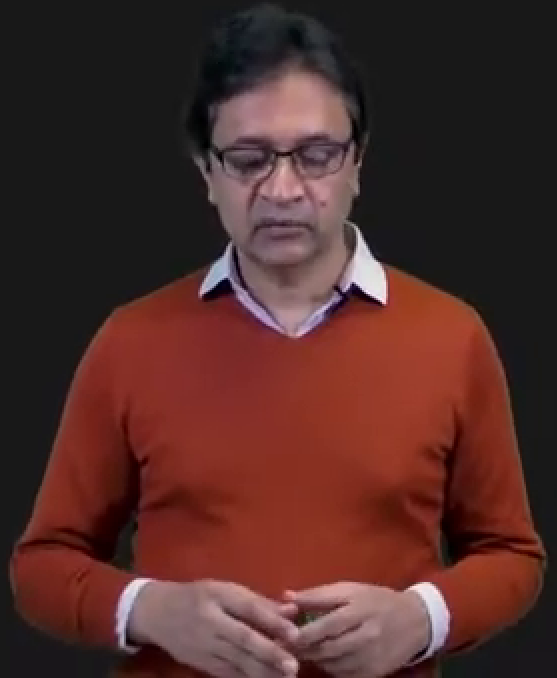
where $(u_l - u_r)$ is called the Disparity.



REVIEW

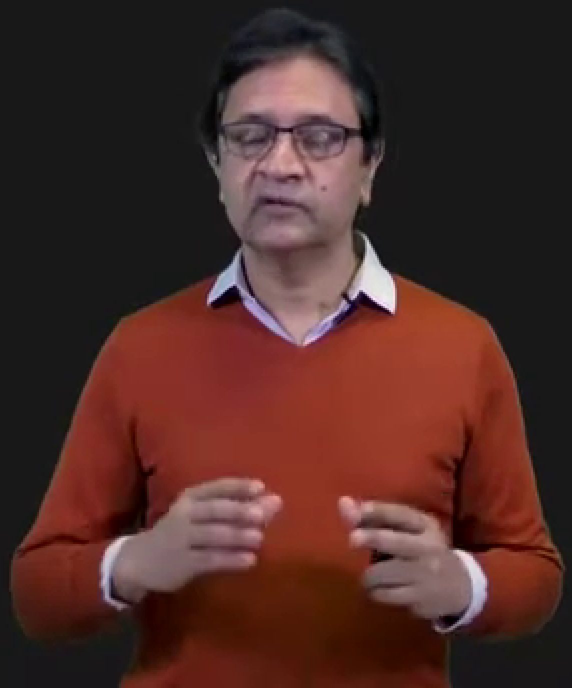
Uncalibrated Stereo

Method to estimate 3D structure of a static scene from two arbitrary views.



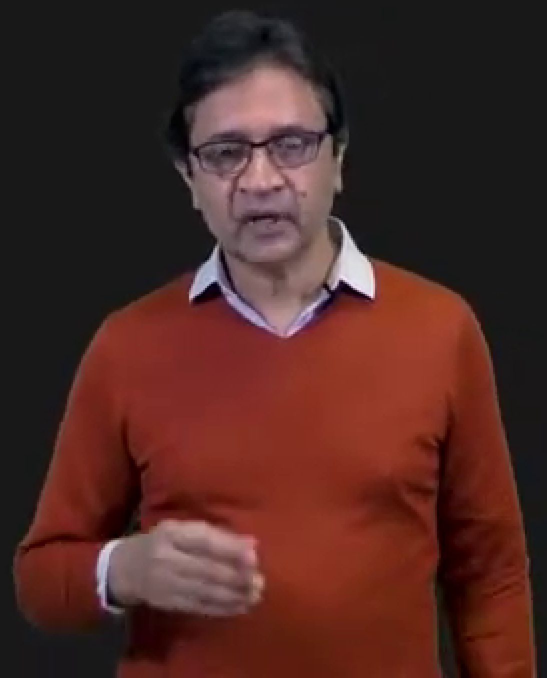
Uncalibrated Stereo

Method to estimate 3D structure of a static scene from two arbitrary views.



Uncalibrated Stereo

Method to estimate 3D structure of a static scene from two arbitrary views.

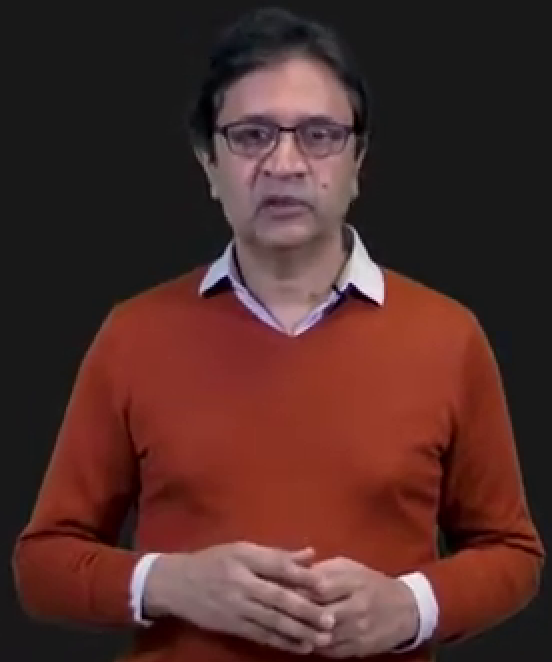


Uncalibrated Stereo

Method to estimate 3D structure of a static scene from two arbitrary views.

Topics:

(1) Problem of Uncalibrated Stereo



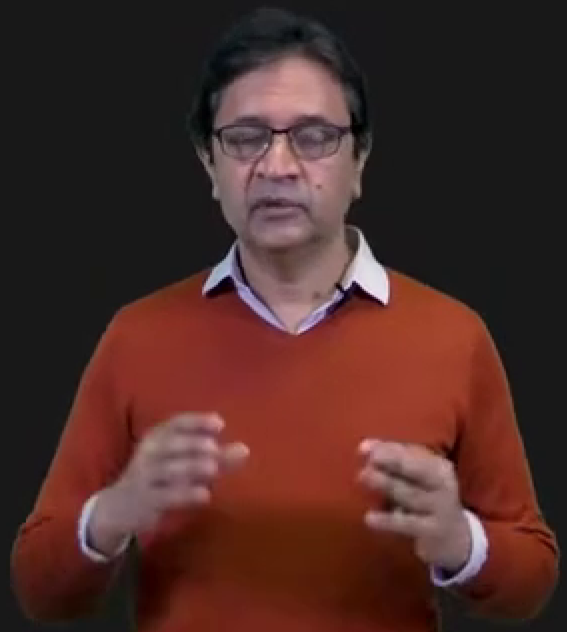
Uncalibrated Stereo

Method to estimate 3D structure of a static scene from two arbitrary views.

Topics:

(1) Problem of Uncalibrated Stereo

(2) Epipolar Geometry



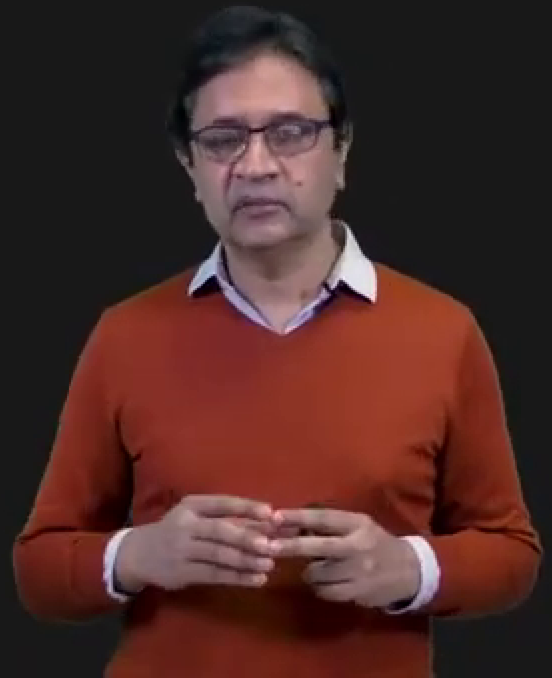
Uncalibrated Stereo

Method to estimate 3D structure of a static scene from two arbitrary views.

Topics:

(1) Problem of Uncalibrated Stereo

(2) Epipolar Geometry



Uncalibrated Stereo

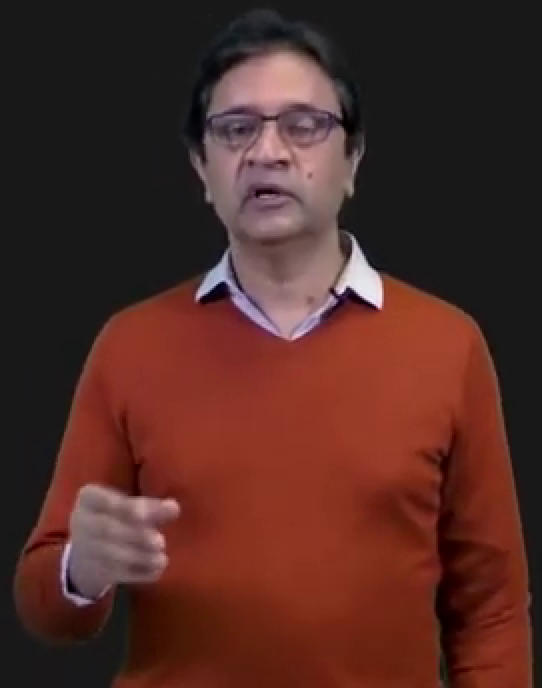
Method to estimate 3D structure of a static scene from two arbitrary views.

Topics:

(1) Problem of Uncalibrated Stereo

(2) Epipolar Geometry

(3) Estimating Fundamental Matrix



Uncalibrated Stereo

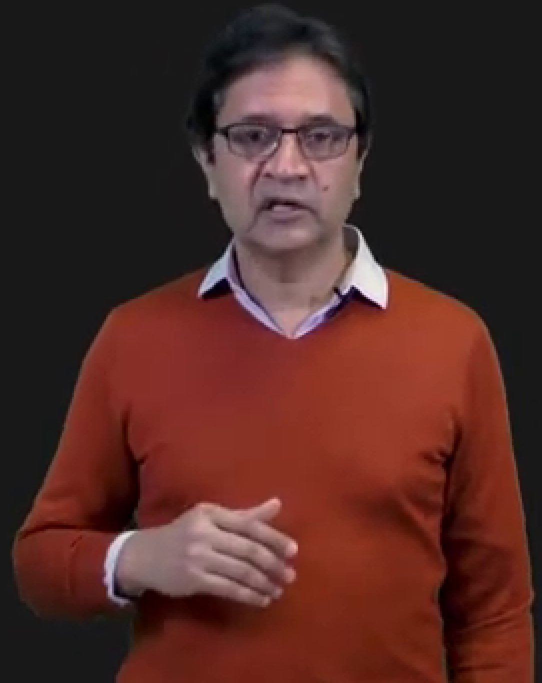
Method to estimate 3D structure of a static scene from two arbitrary views.

Topics:

(1) Problem of Uncalibrated Stereo

(2) Epipolar Geometry

(3) Estimating Fundamental Matrix



Uncalibrated Stereo

Method to estimate 3D structure of a static scene from two arbitrary views.

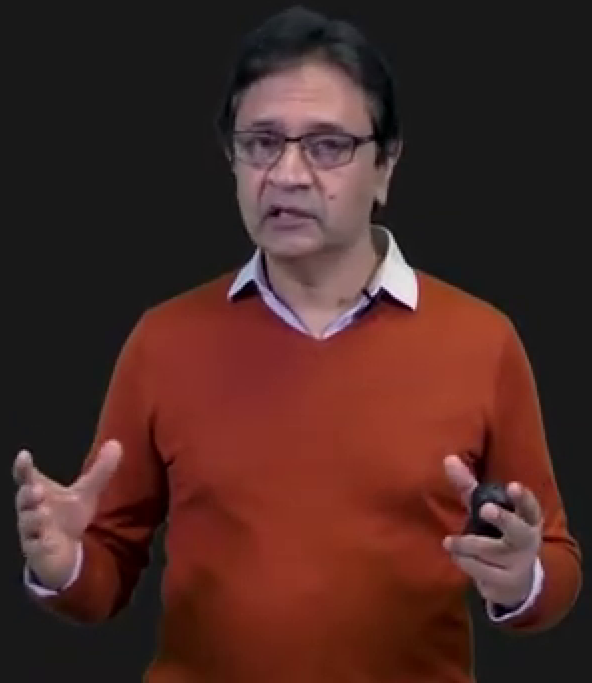
Topics:

(1) Problem of Uncalibrated Stereo

(2) Epipolar Geometry

(3) Estimating Fundamental Matrix

(4) Finding Dense Correspondences



Uncalibrated Stereo

Method to estimate 3D structure of a static scene from two arbitrary views.

Topics:

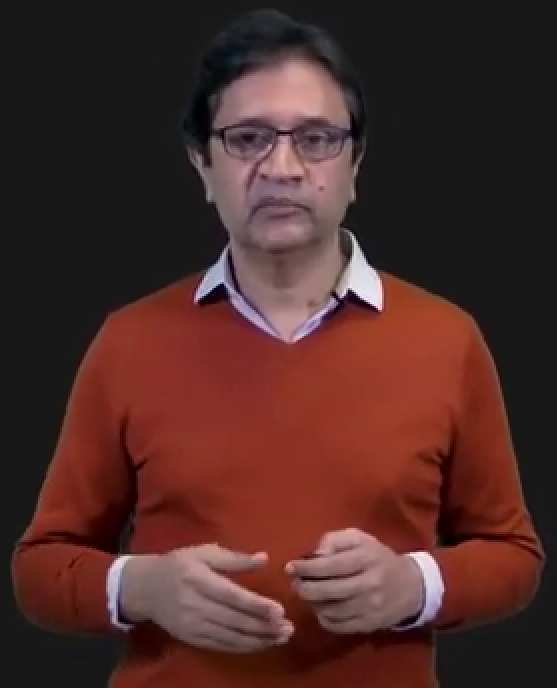
(1) Problem of Uncalibrated Stereo

(2) Epipolar Geometry

(3) Estimating Fundamental Matrix

(4) Finding Dense Correspondences

(5) Computing Depth



Uncalibrated Stereo

Method to estimate 3D structure of a static scene from two arbitrary views.

Topics:

(1) Problem of Uncalibrated Stereo

(2) Epipolar Geometry

(3) Estimating Fundamental Matrix

(4) Finding Dense Correspondences

(5) Computing Depth

(6) Stereopsis: Stereo in Nature