Introduction to Computer Vision
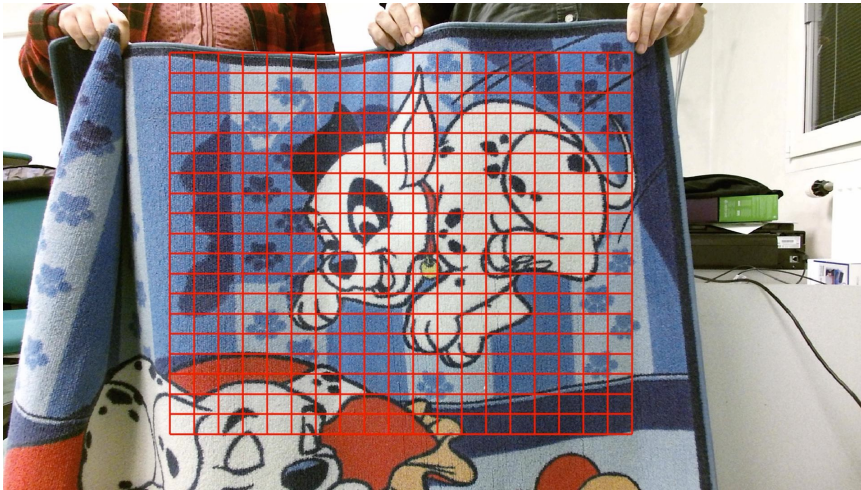## (to appear as Fundamentals of Image Processing and Interpretation)

Shaifali Parashar (CNRS Research Scientist)

About me

- Born and raised in India.
- Moved to France in 2012 but cannot speak French.
- Did my Masters in UB, Dijon and PhD in UDA, Clermont-Ferrand.
- Moved to EPFL, Switzerland for postdoc.
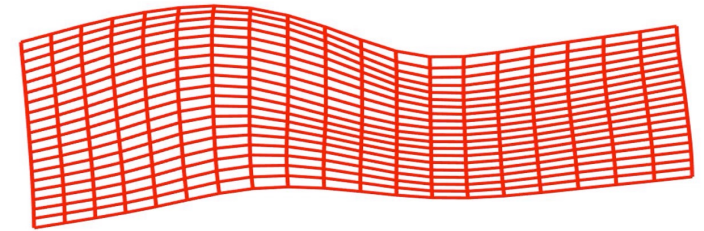- In CNRS, Lyon since 2022.

My Research

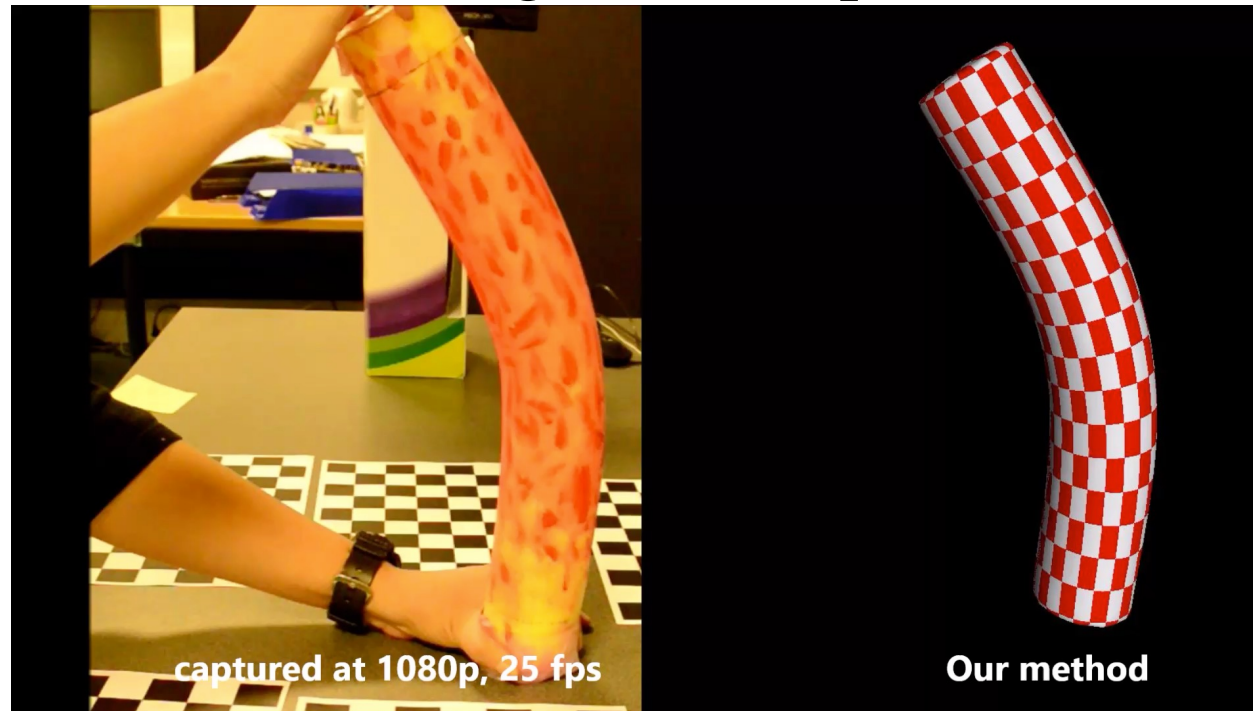- Non-Rigid Structure-from-Motion

Multiple registered images

$$\xrightarrow[\text{PAMI 2017}]{\text{NRSfM}}$$

My Research

- Video- Editing

Eurographics 2019

My Research

- Volumetric Reconstruction using a 3D template

captured at 1080p, 25 fps

Our method

ICCV 2015

My Research

- Realistic Garment-Fitting PAMI 2020

| Garnet | Garnet with curvature loss | Ground truth |

My Research

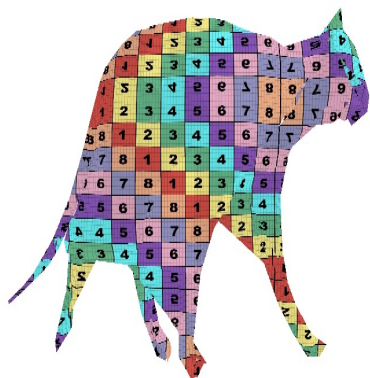- Parametric Surface Learning – CVPR 2020
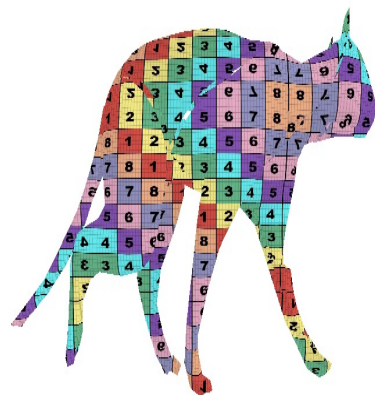

| Ground truth | AtlasNet | Ours |
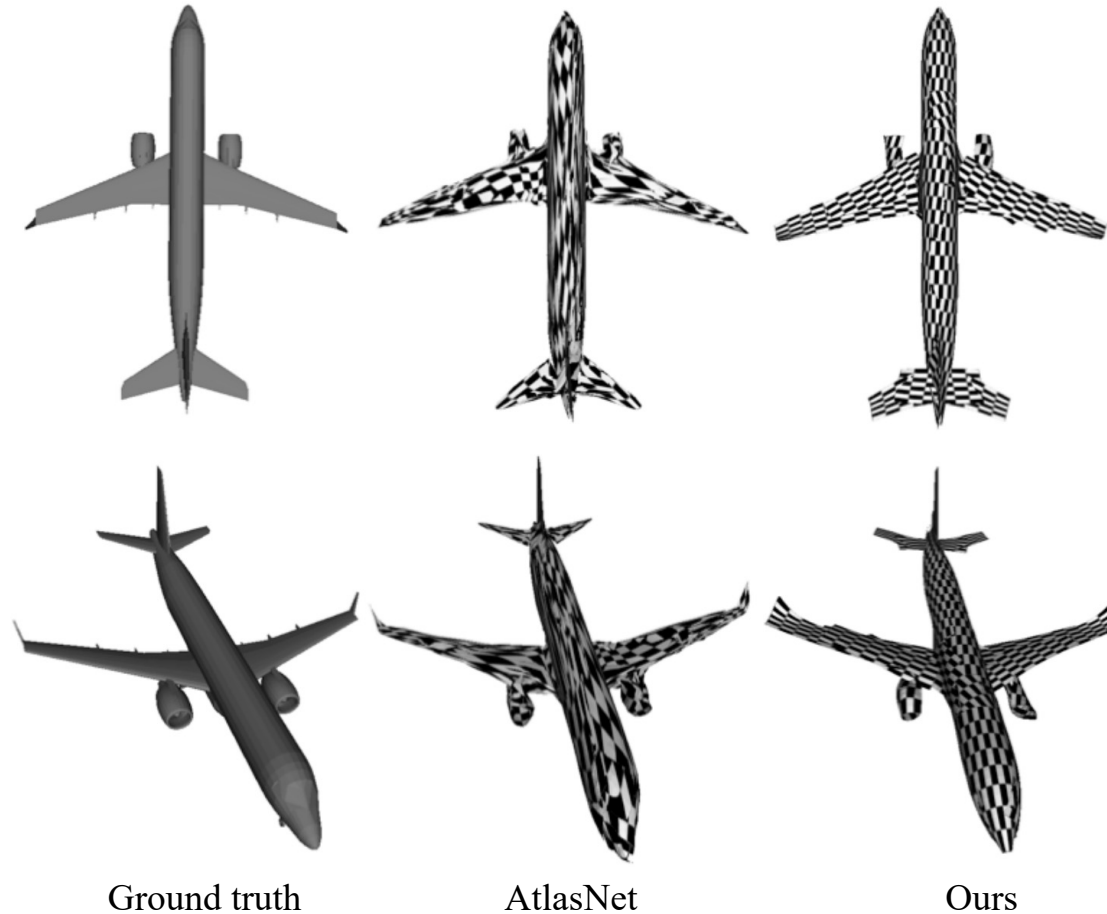
My Research

- Deformable 3D Regristration – ICCV 2021

Reconstruction

Error

AtlasNet

Ours

AtlasNet

Ours

Computer Vision (Image interpretation)

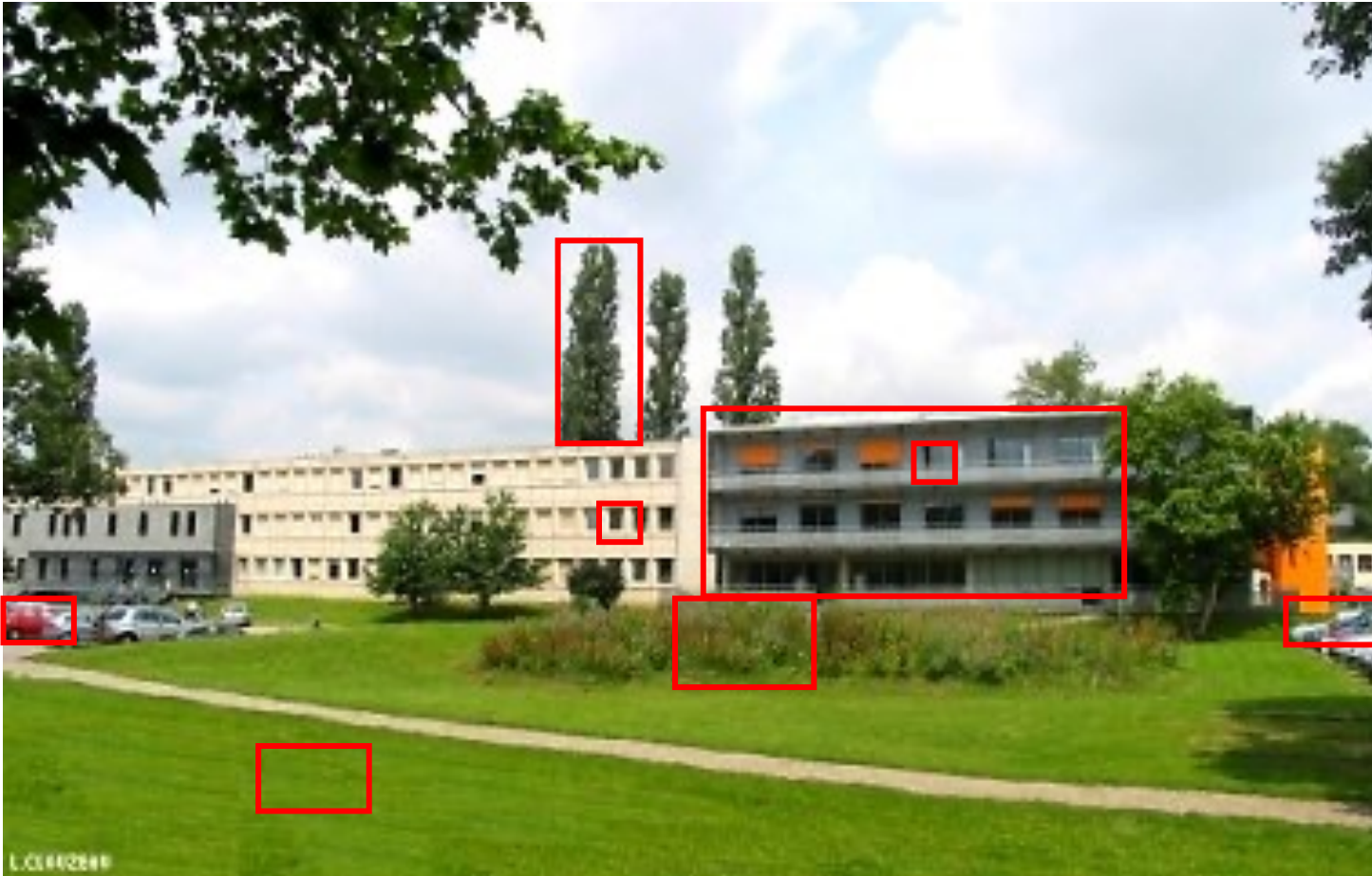To interpret the world seen through cameras as RGB images

Observations:
Colors
- green, blue, white, gray, orange, red
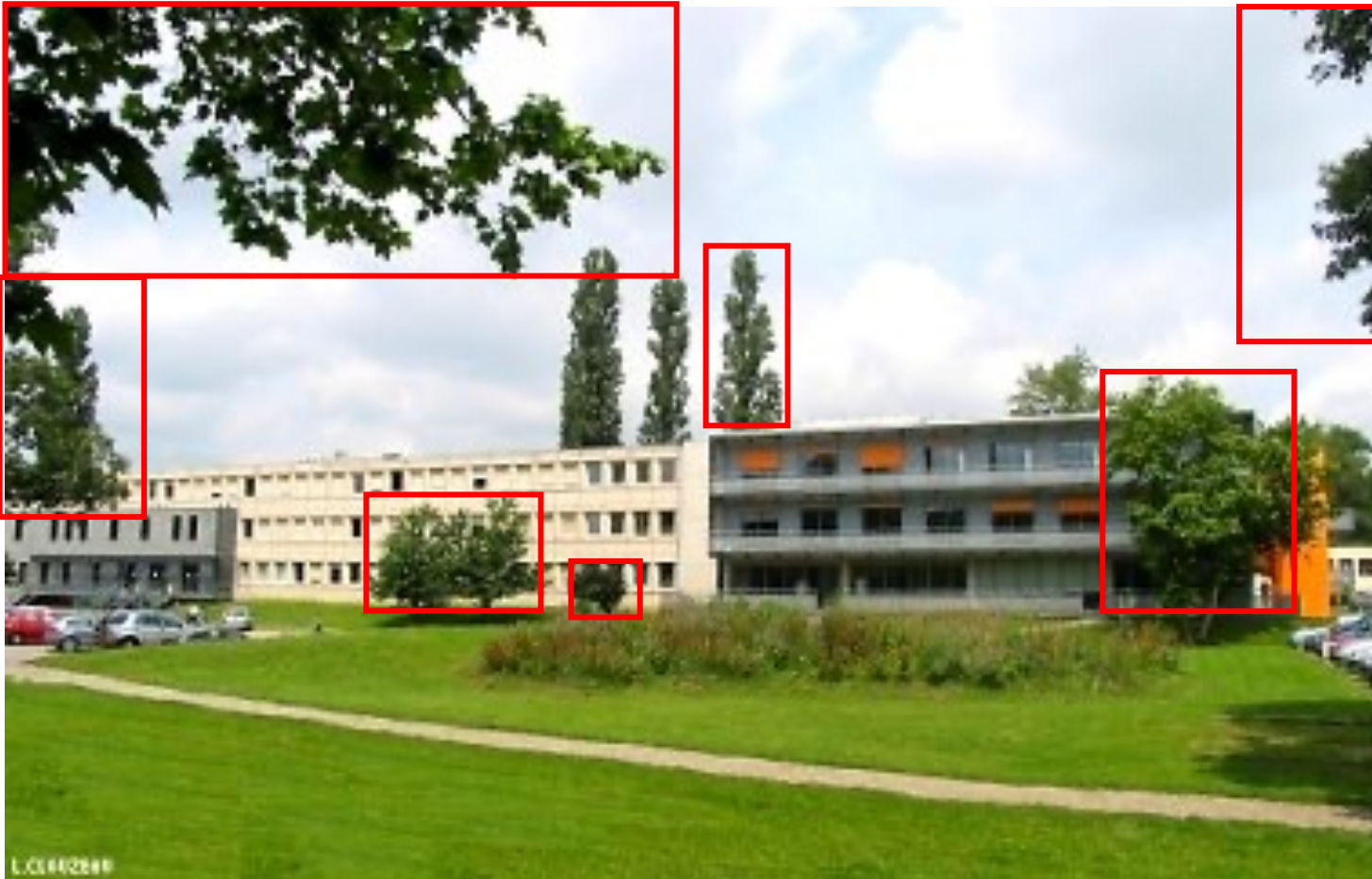
Computer Vision (Image interpretation)

Objects
- Grass, plants and trees
- Cars
- Buildings
- Doors
- Windows

Computer Vision (Image interpretation)

All are trees.

Computer Vision (Image interpretation)

All are windows

Computer Vision (Image interpretation)

All is grass.

Computer Vision (Image interpretation)

All are cars.

Computer Vision (Image interpretation)

Geometric observations:
These buildings are next to each other.
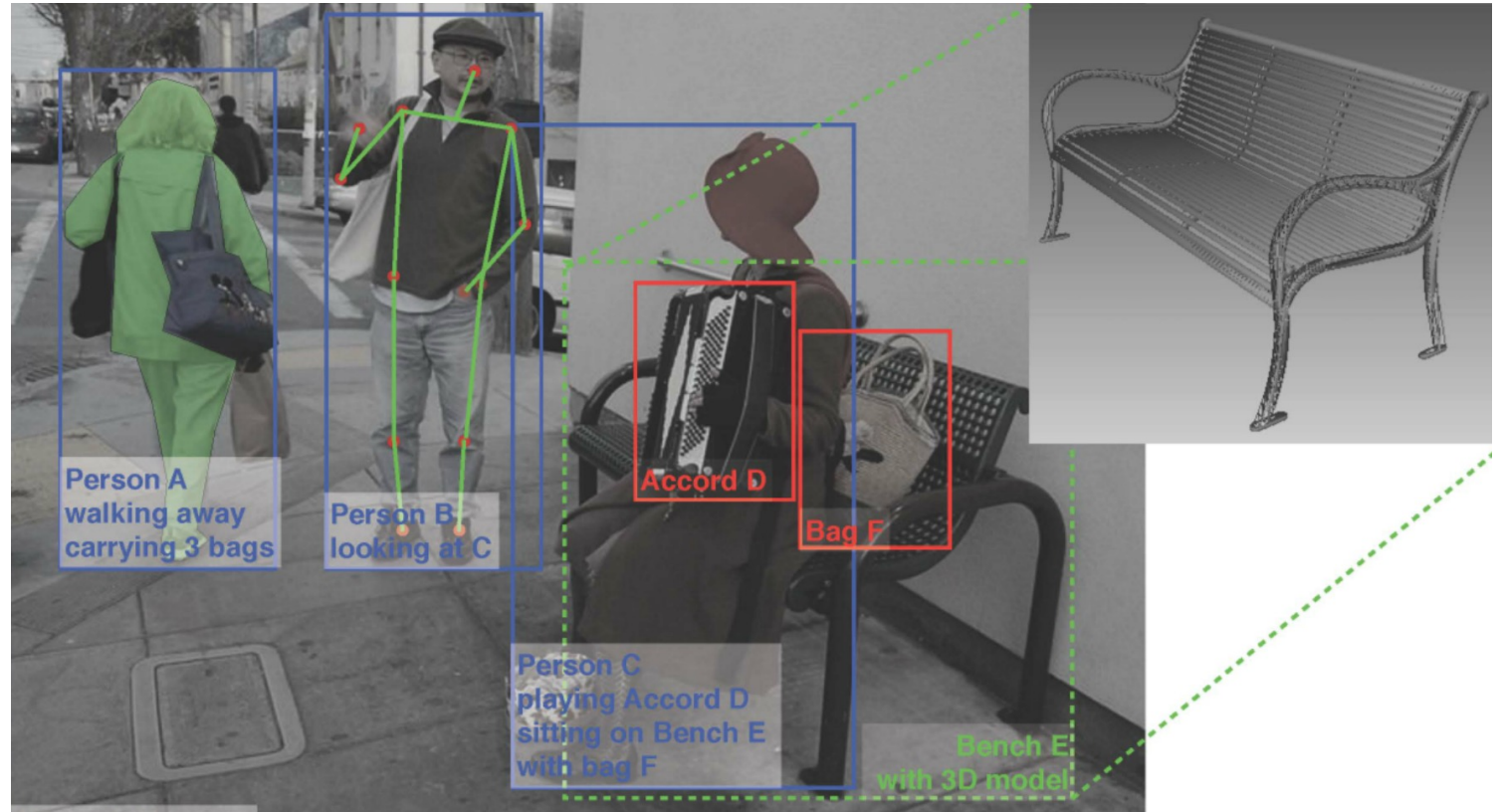
Computer Vision (Image interpretation)

Geometric obstervations:
This is not on the same lane as other two.
It is nearer to the camera.
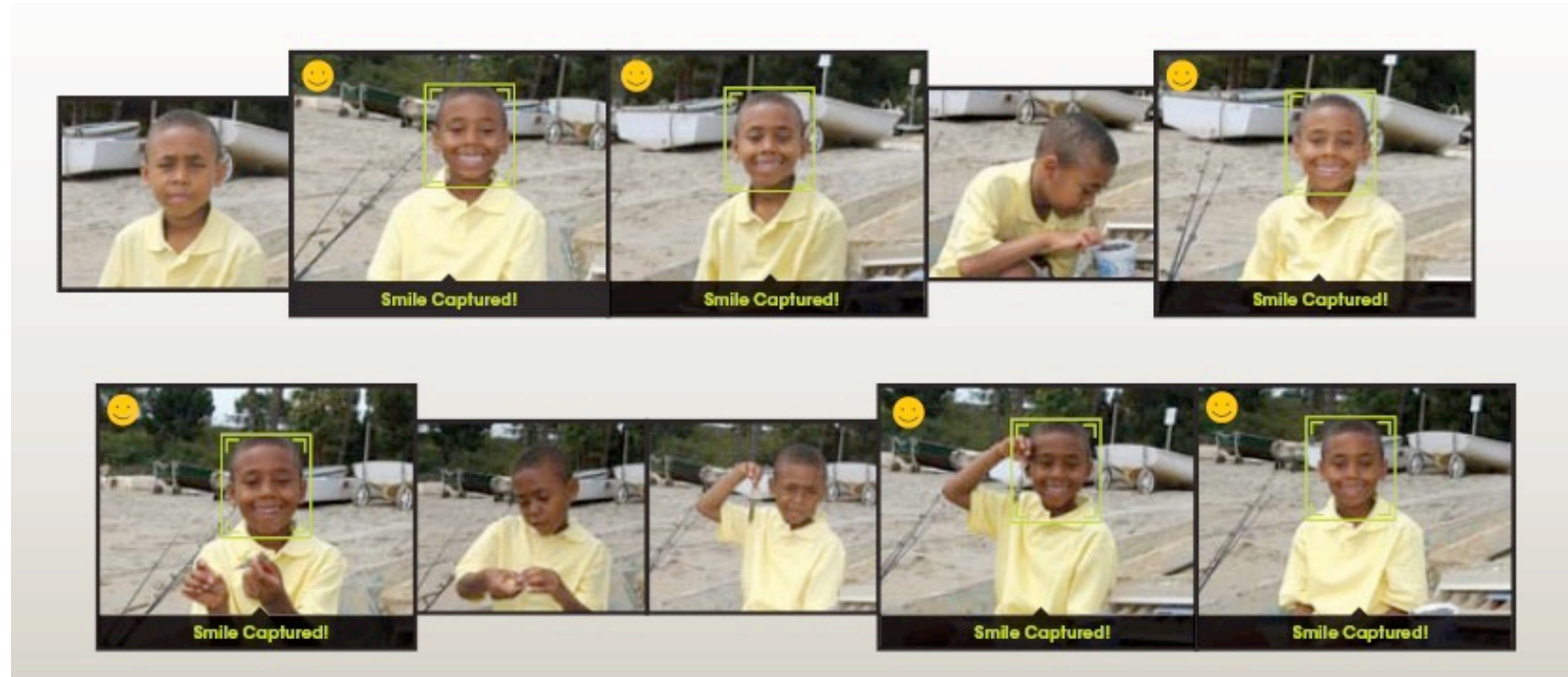
Computer Vision: An Overview

What do images tell?

- Objects
- Activities
- Scenes
- Locations

Computer Vision: An Overview

What do images tell?

- Faces

- Gesture

- Emotions

Computer Vision: An Overview

What do images tell?

- Text Detection- OCR

- Handwriting detection

License plate readers

http://en.wikipedia.org/wiki/Automatic_number_plate_recognition

Computer Vision: An Overview

What do images tell?

- Motion Analysis

Computer Vision in Sports

Computer Vision: An Overview

What do images tell?

- 3D structure

[Furukawa et al. CVPR 2010]

Course Overview

- Slides available on https://github.com/shaifaliparashar/Lyon1_CV_lectures
- Topics
  1. Basic Image Processing
  2. Feature Extration and Image Registration
  3. Image transformations and panaroma views
  4. Optical Flow
  5. Multiple-view geometry
  6. Camera calibration
  7. 3D reconstruction
  8. Shape from Shading
- Evaluation
  1. Labwork + Homework (50 %)
  2. Paper implementation + presentation (25%)
  3. Exam (25%)

Prerequisites

1. Linear algebra review: http://cs229.stanford.edu/section/cs229-linalg.pdf