E1.216 COMPUTER VISION

LECTURE 01: INTRODUCTION

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Department of Electrical Engineering
Indian Institute of Science, Bengaluru

2026

No Cell Phones in Class

No ringing phones, no messaging!

COMPUTER VISION

E1.216: Computer Vision (3:1)

`http://ee.iisc.ac.in/~venu`

Instructor:
Venu Madhav Govindu
Email: venug@iisc.ac.in

Pre-requisites and logistics

- **Pre-requisites:**
  - Linear Algebra
  - Probability
  - Signal Processing
  - *Optimization*
- Class Hours: Monday and Wednesday 2-4pm (B-306, EE)
- Make use of course webpage
- Undergraduates: need explicit permission (only 4th year)
- Last date of registration: 15 January 2026

Motivation

Of all the human senses, vision is the richest in content and perhaps the hardest to formalise in a rigorous manner. As a discipline, Computer Vision covers a wide variety of methods for interpretation and analysis of visual data using a computer. In this course we will present a broad, introductory survey of the field. The objective of the course is to develop a familiarity with the approaches to modelling and solving problems in computer vision. Mathematical modelling and algorithmic solutions for vision tasks will be emphasised.

What is Computer Vision?

- Computer Vision $\neq$ Image Processing
- Computer Vision $\neq$ Deep Learning

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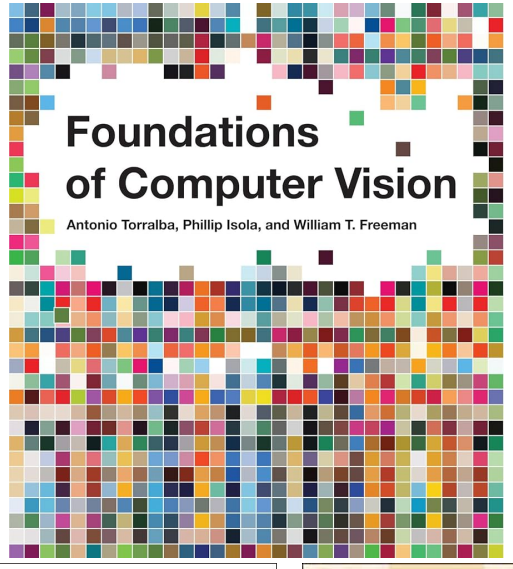

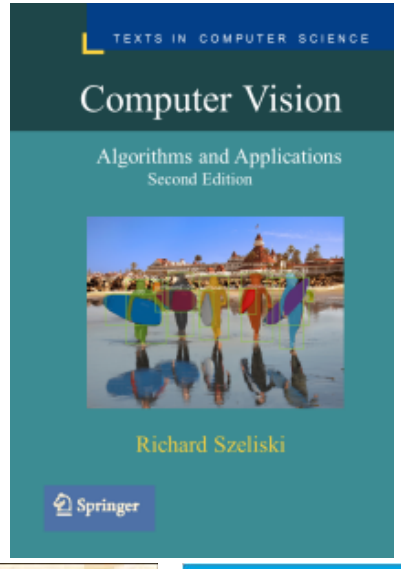

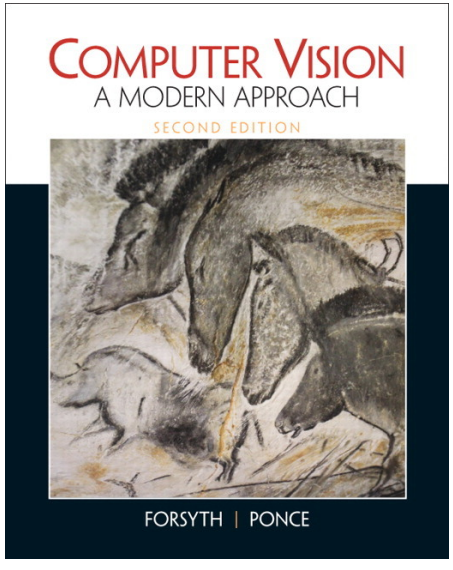

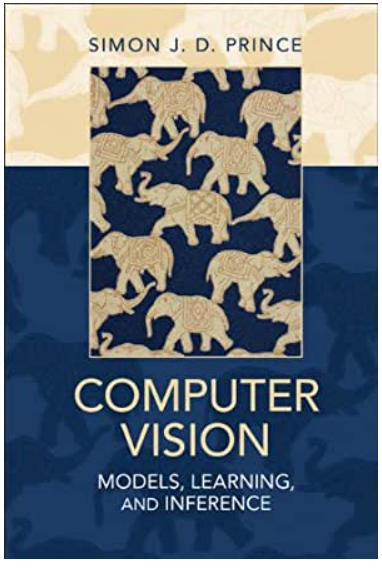

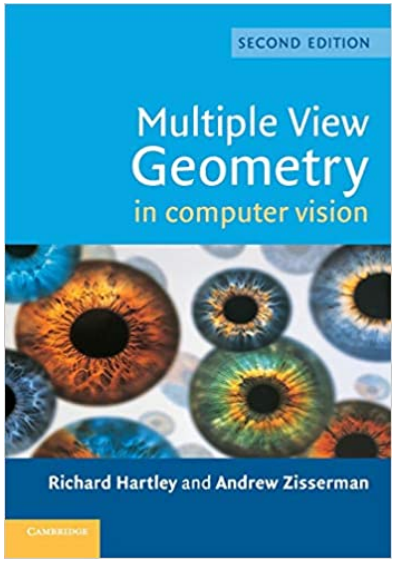

Objectives

- Images to understand physical world
- Functional replication of visual perception
- Develop suitable theory, models, algorithms
- Contexts
  - Image analysis in different domains
  - Recognition, scene interpretation, motion estimation, tracking, grouping etc.
  - 3D understanding of the world
- High-level reasoning is hard to define
- Low-level information processing is better understood
- Significant advances in understanding of geometry

Contemporary scenario

- Massive volumes of data (cheap cameras, internet)
- Cheaper computational resources (GPUs)
- Statistical issues of increasing interest
- Huge advances in deep learning etc.
- Computer Vision goes mainstream
  - Real world impact
  - Developments + Hype
  - Serious social implications
  - Ethics, Fairness, Failures major considerations

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- Image Features
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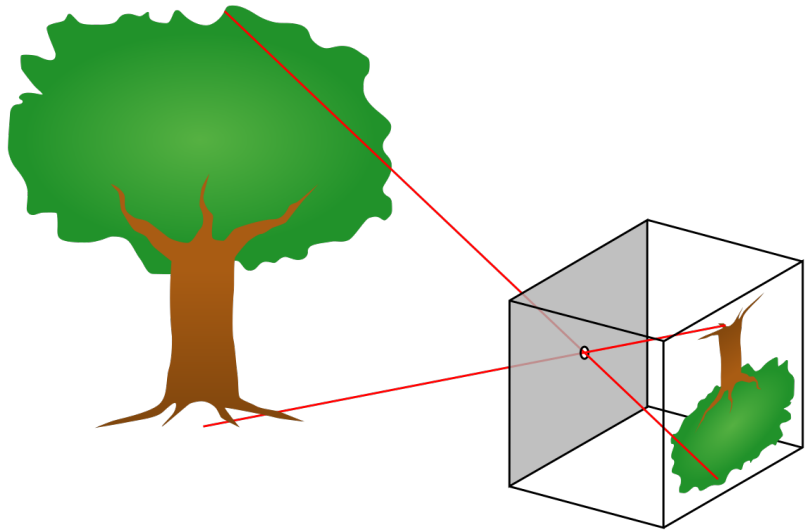

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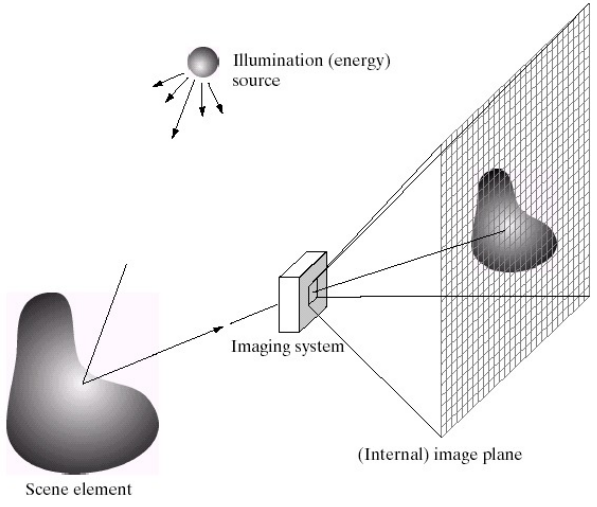

Alexei Efros; Plenoxels

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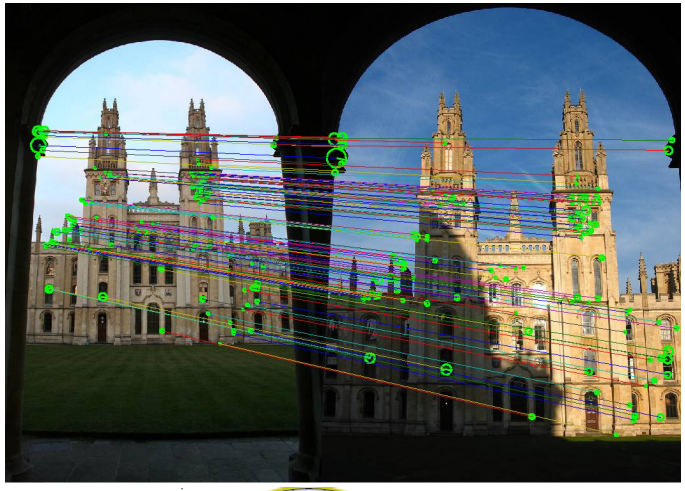

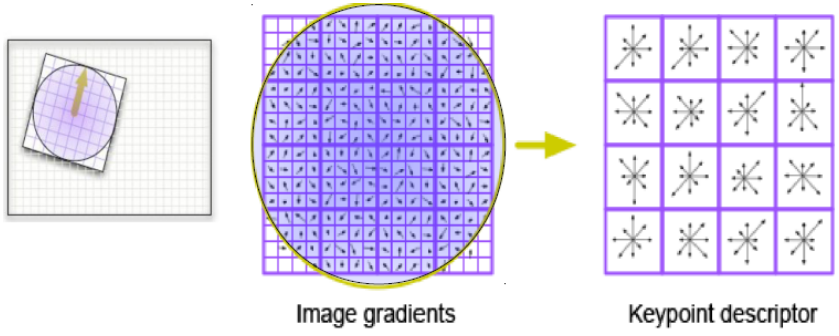

blog.ekbana.com

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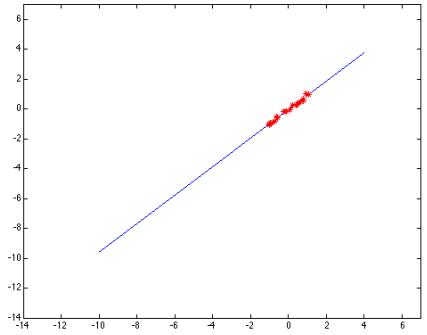

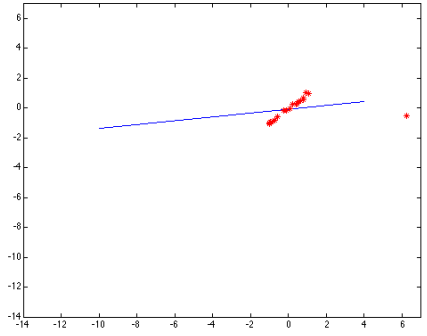

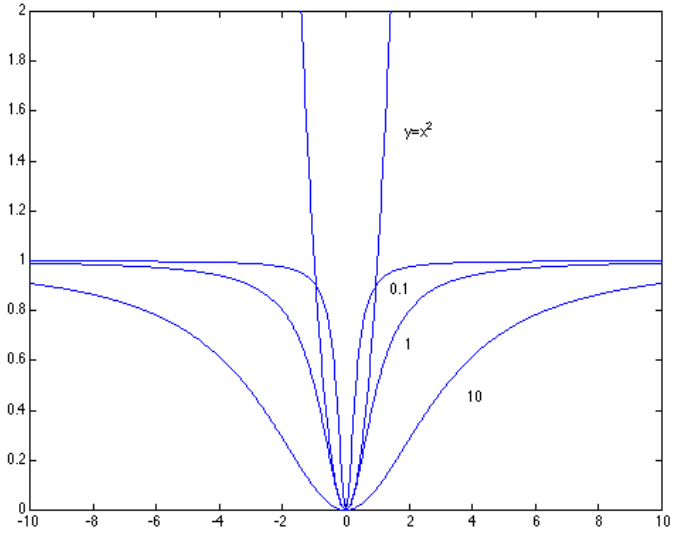

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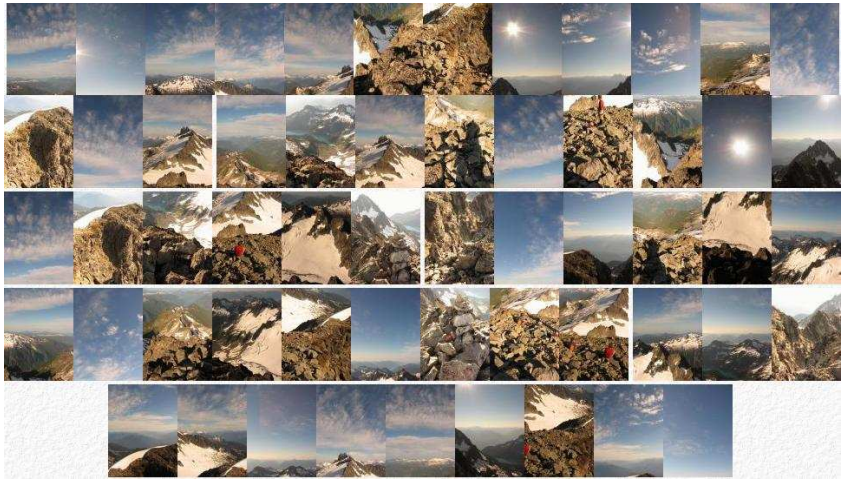

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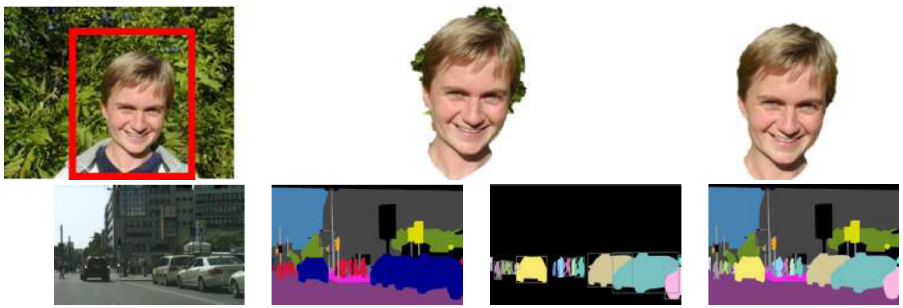

Szeliski 1st and 2nd Editions

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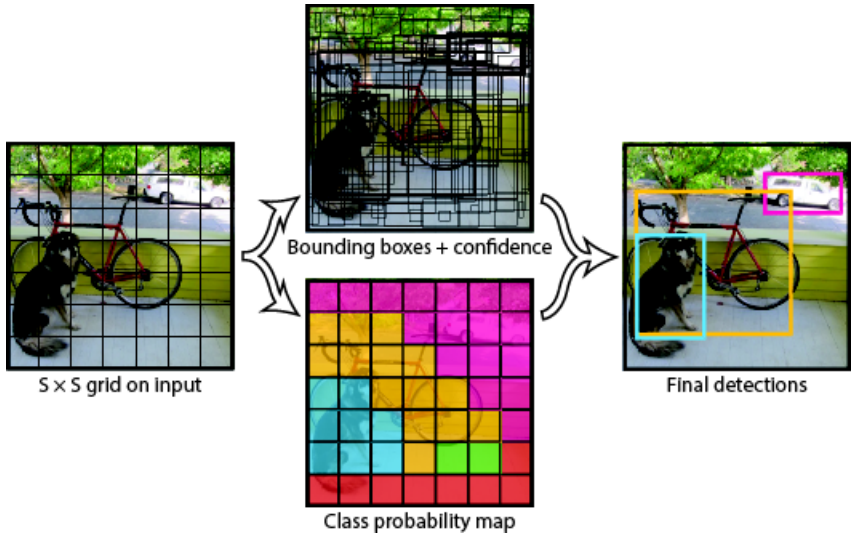

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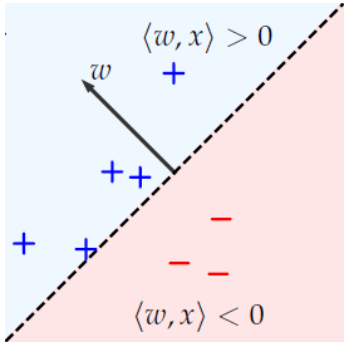

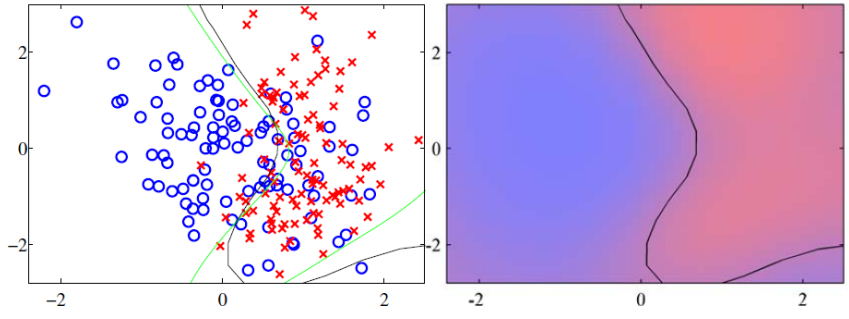

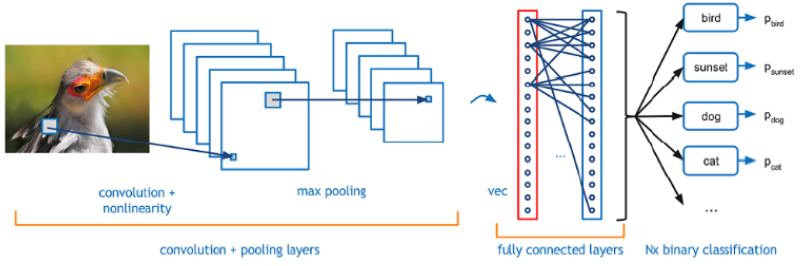

Hardt+Recht, Bishop, O'Mahony DL vs Traditional CV

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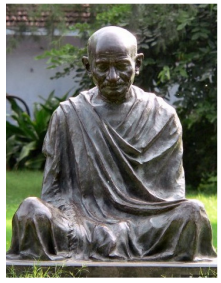
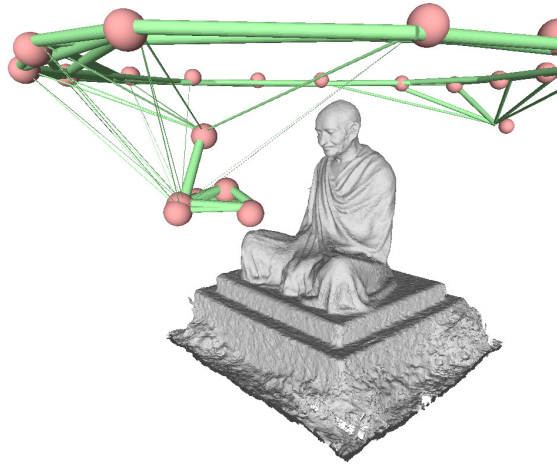

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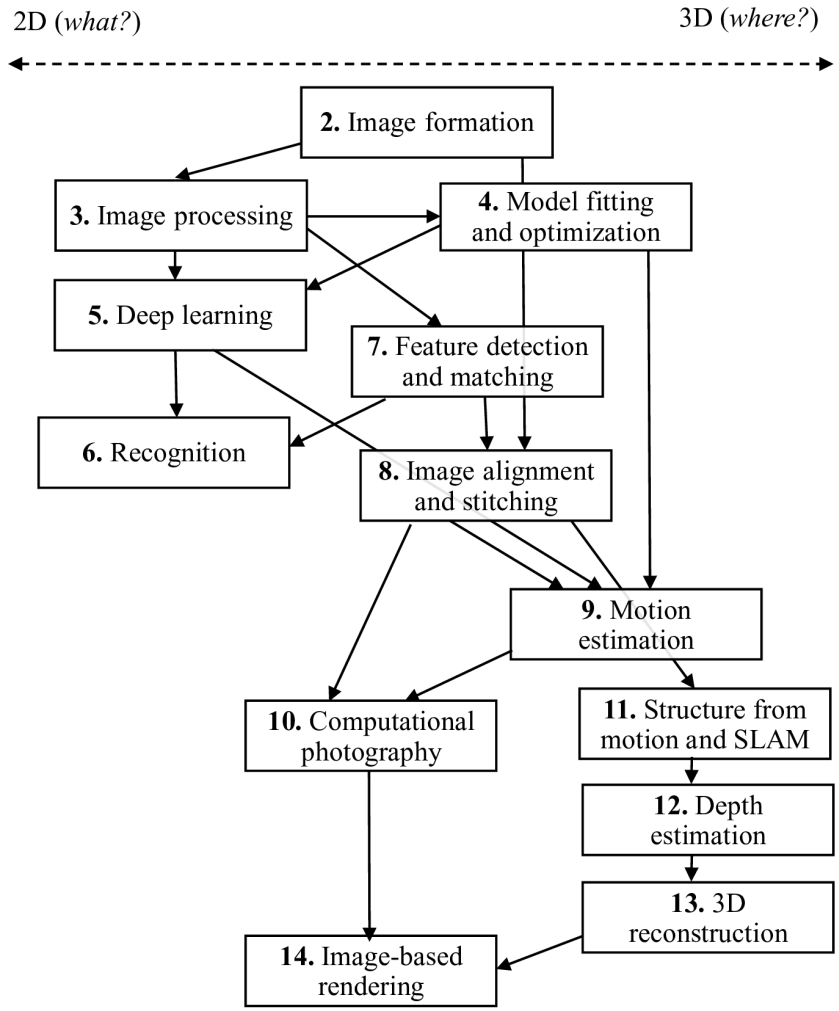

Szeliski Second Edition

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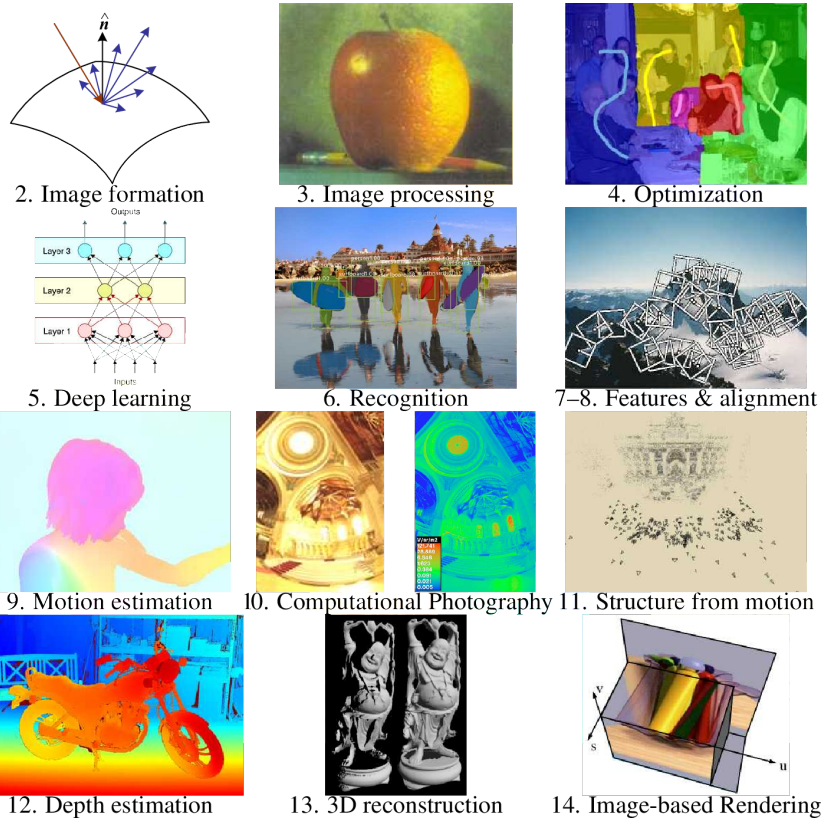

Szeliski Second Edition

3D Reconstruction from Images

- Take lots of pictures
- We took around 2500 of them!
- Solve the *structure-from-motion* problem (invert image formation)
- And the result is $\cdots$

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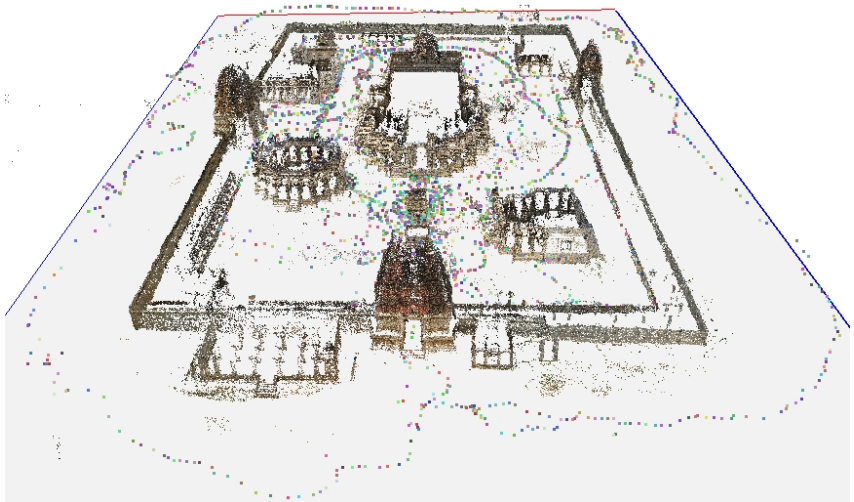

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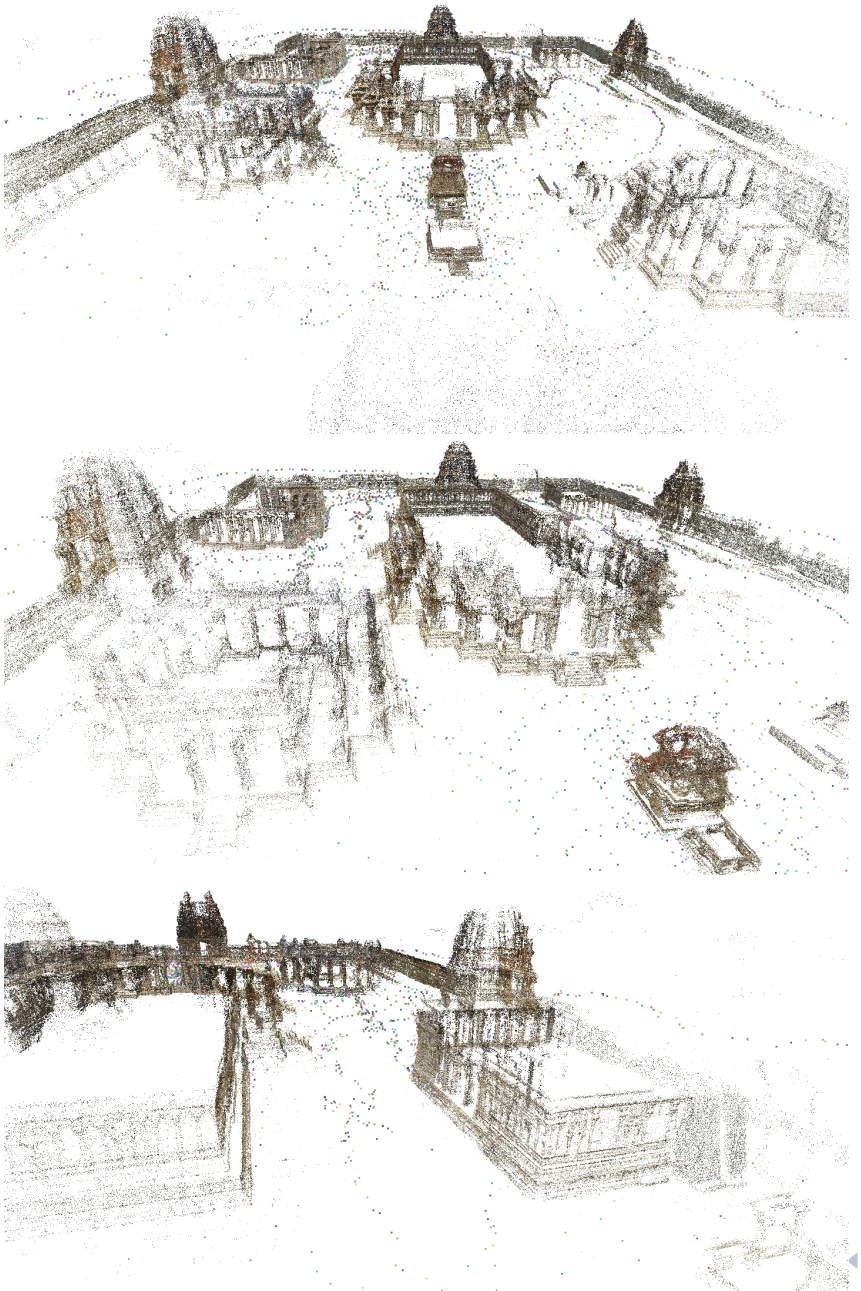
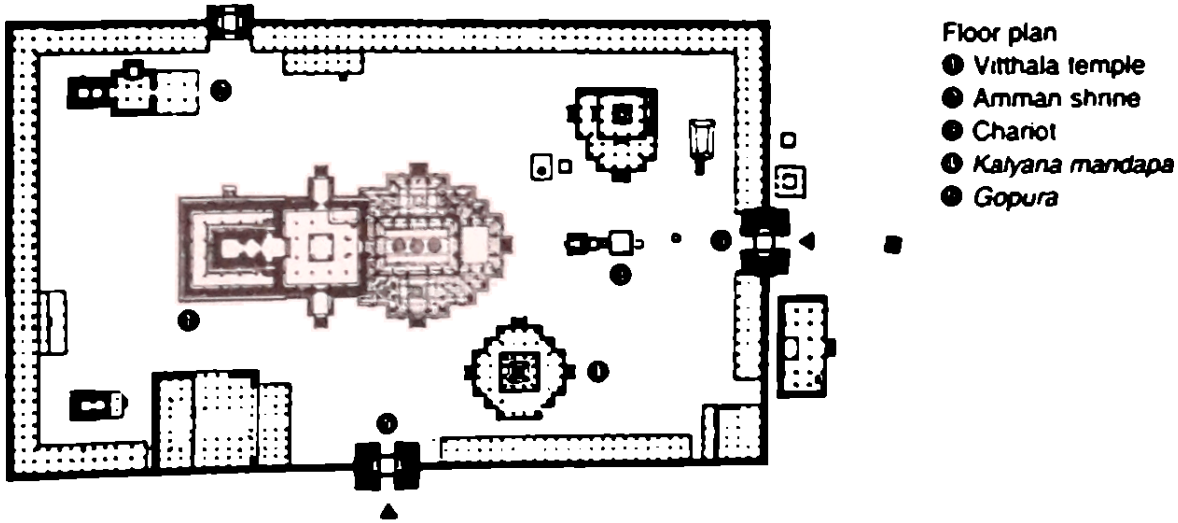
Vitthala Temple, Hampi

Rendering of our 3D model

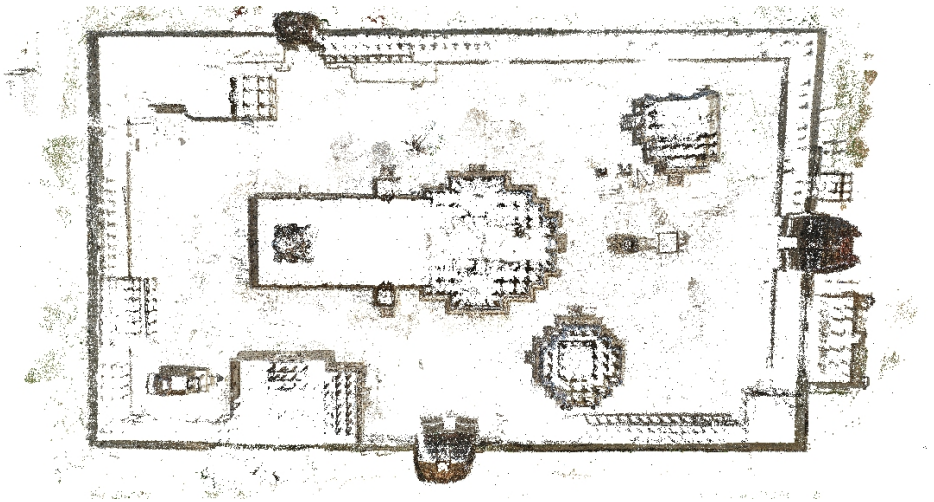


Vitthala Temple, Hampi

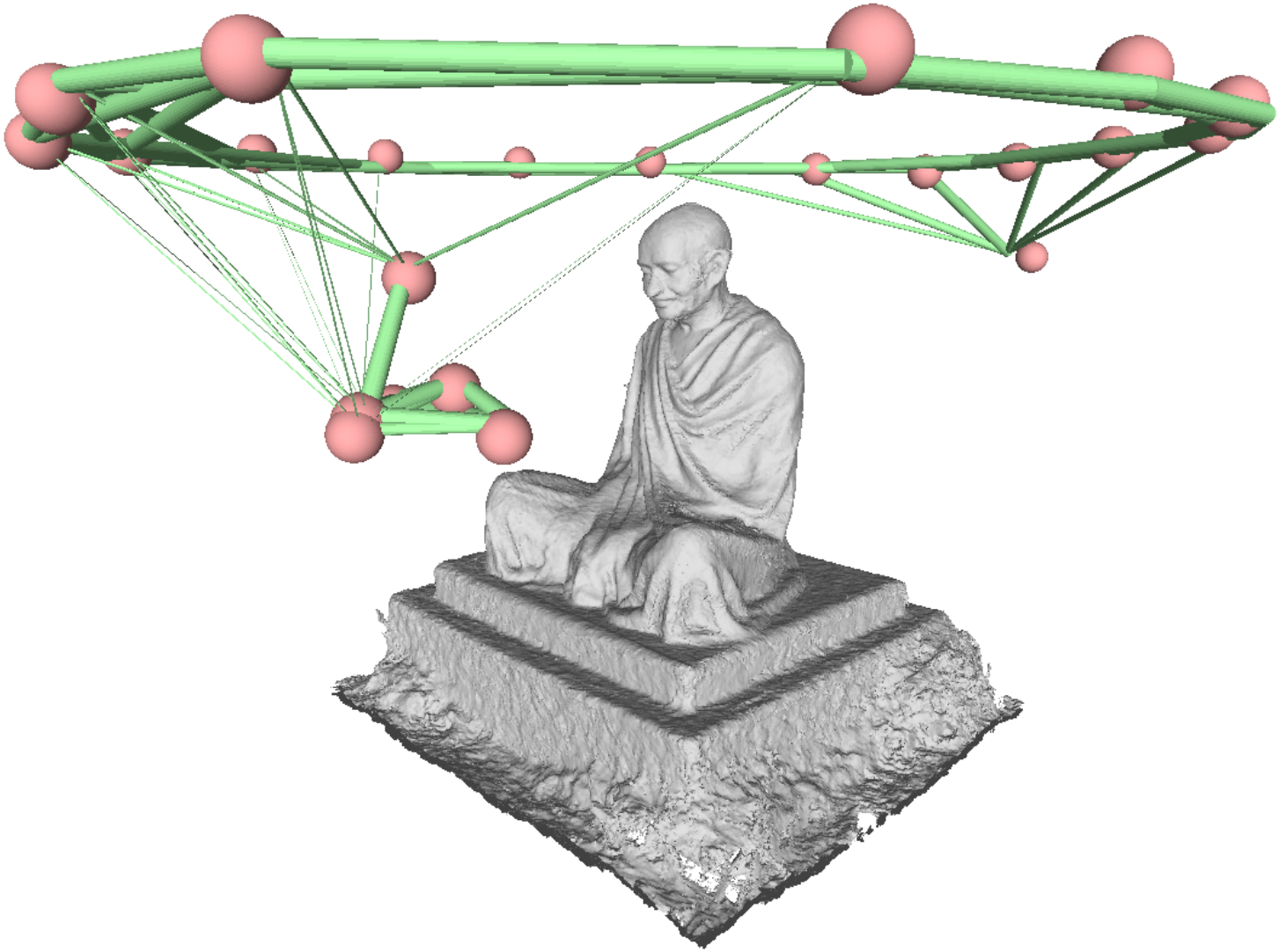
Comparison of Reconstruction



(a) Architectural Drawing



(b) Reconstruction



Mahatma Gandhi Statue @ Sabarmati Ashram