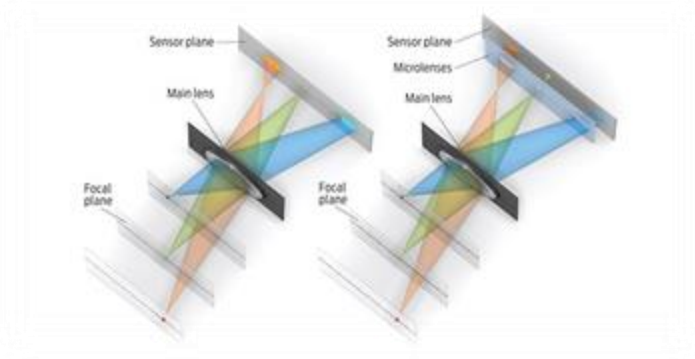
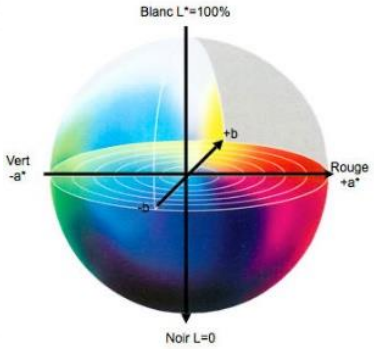
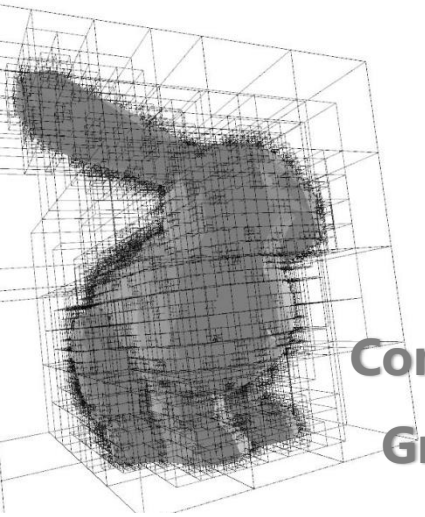
Image-Based Graphics







Computer Graphics

Dr. Fanglue Zhang

CGRA352 2025

Victoria University of Wellington

Course Information

- **Lectures:** Mondays and Tuesdays at 14:10 pm
- **Tutorials:** Thursday at 14:10 am
- **Location: Murphy 302/301**
- **Coordinator and lecturer:**

  Dr. Fanglue Zhang (fanglue.zhang@vuw.ac.nz)

  Tutor: Jun (Iris) Zheng (iris.zheng@vuw.ac.nz)
- Please refer to the class webpage for announcement, lecture notes and materials:
  - https://ecs.victoria.ac.nz/Courses/CGRA352_2025T1/

Textbook and materials

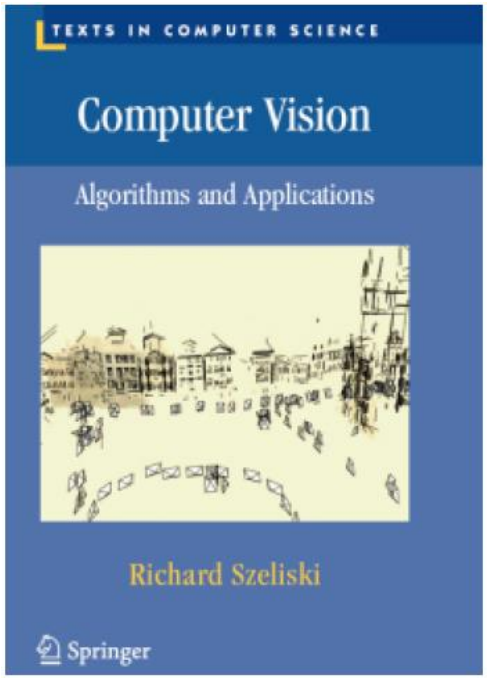
- Textbook: We won't directly follow any book, but reading in this textbook will be very useful:
- **Computer Vision: Algorithms and Applications.**

  By Rick Szeliski

  It is available free online and in VUW library,

  – http://szeliski.org/Book/
- Links to other materials (papers, code, etc)

  will be posted on the class webpage



Grading

- Each student is expected to complete 4 projects:
  - Project 1: 15 marks
  - Project 2: 30 marks
  - Project 3: 25 marks
  - Project 4: 30 marks
- Late submissions will get penalties.

  -- each day for 5%, no marks after 7 days, 3 free late days
- For each project, you need to hand in a report and packages of source code for different parts: core, completion and challenge.
- Every assignment will be marked by a face2face or online marking session (5-8min each)

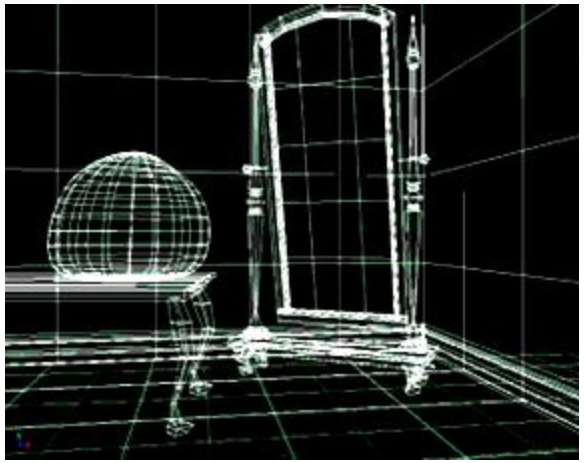
Programming language

- **We will only provide tutorials and example codes for C++, with an open source package called OpenCV.**

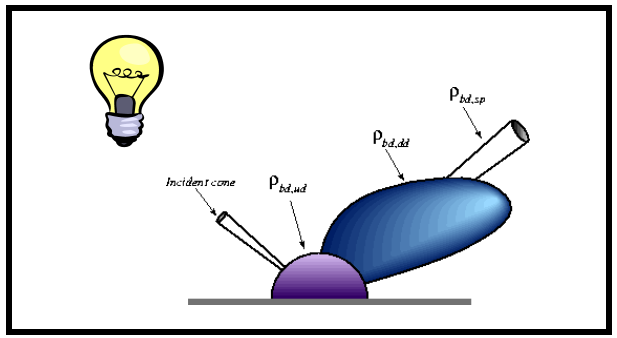
- But if you prefer other languages like Python and Matlab, it is OK.
  - As long as it compiles, runs and generates correct results, we're happy
  - OpenCV also supports Python.

Image-Based Computer Graphics

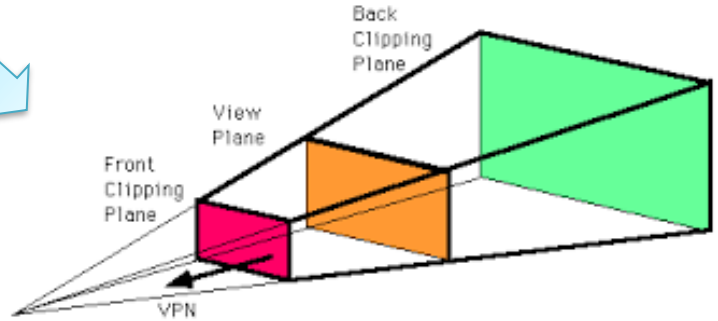
- Traditional Computer Graphics



3D geometry



Simulation and Lighting



Projection & Rasterization

Display

Richness and complexity of the real world

- The richness of our everyday world

A rendered scene

Small island in a real world photo
Beauty in natural complex details

Richness and complexity of the real world

- The richness of our everyday world

A rendered scene
(Playerunknown's Battlegrounds)

Real photo

Richness and complexity of the real world

- The richness of our everyday world

Image-Based Computer graphics

- **Use photographic imagery to create graphics content**

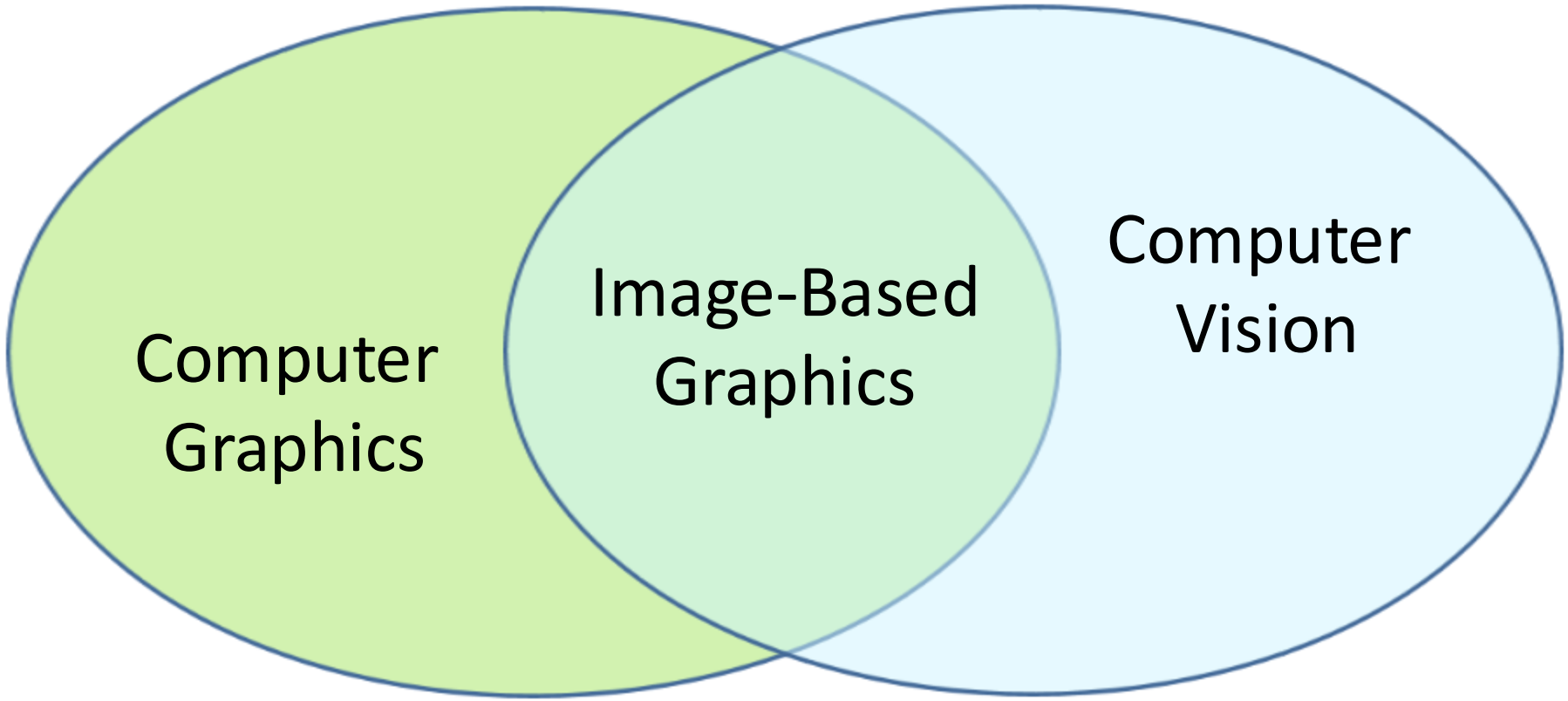


Image-Based Computer graphics

- **Use photographic imagery to overcome the limitation of digital photography and create novel graphics content**
- **Enable data-rich imaging and image-based rendering**

HDR Imaging

Enhancement & Manipulation
(Composition, panorama…)

Advanced Imaging Hardware

Image Based
Rendering and Modeling

Overcome limitations of digital photography

High dynamic range (HDR) imaging

Overcome limitations of digital photography

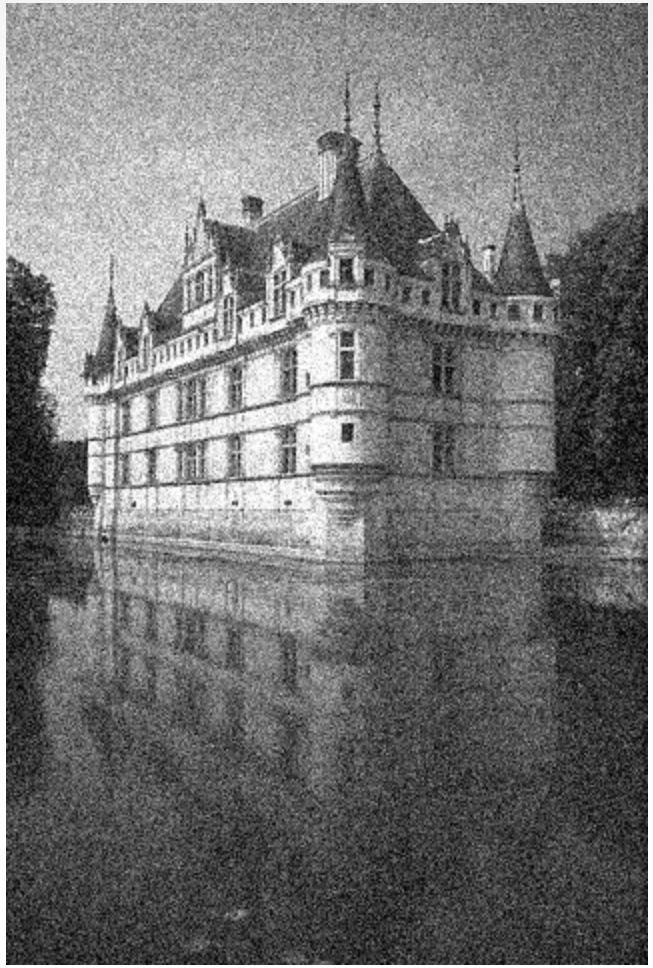
High dynamic range (HDR) imaging

Overcome limitations of digital photography

To obtain an HDR image, multiple photos with different exposure levels are combined by a technique called tone-mapping.

Overcome limitations of digital photography

- Denoising
- Bilateral filtering



Overcome limitations of digital photography

- Deblur

Overcome limitations of digital photography

- Deblur

Overcome limitations of digital photography

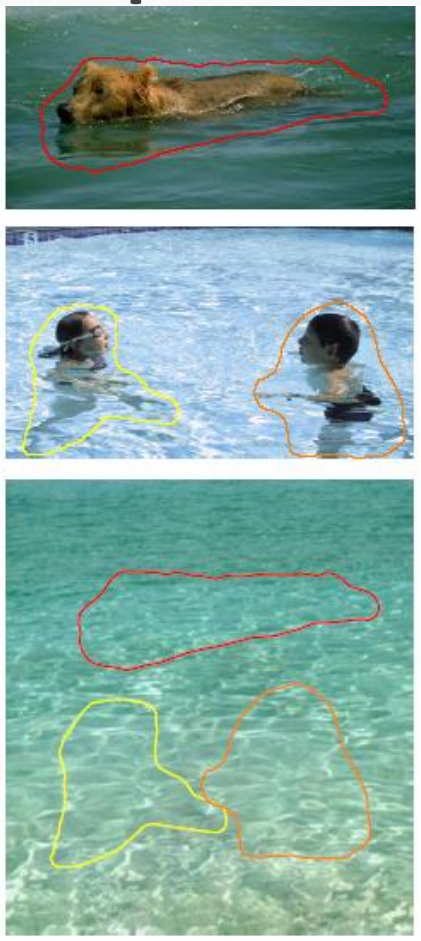
- Stabilization

Original
youtube.com/watch?v=2S_U1pnLE-M

Stabilized Result
80% crop

Create realistic new imagery

- Composition



sources/destinations

cloning

seamless cloning

Gradient domain image manipulation (Poisson Image Editing)

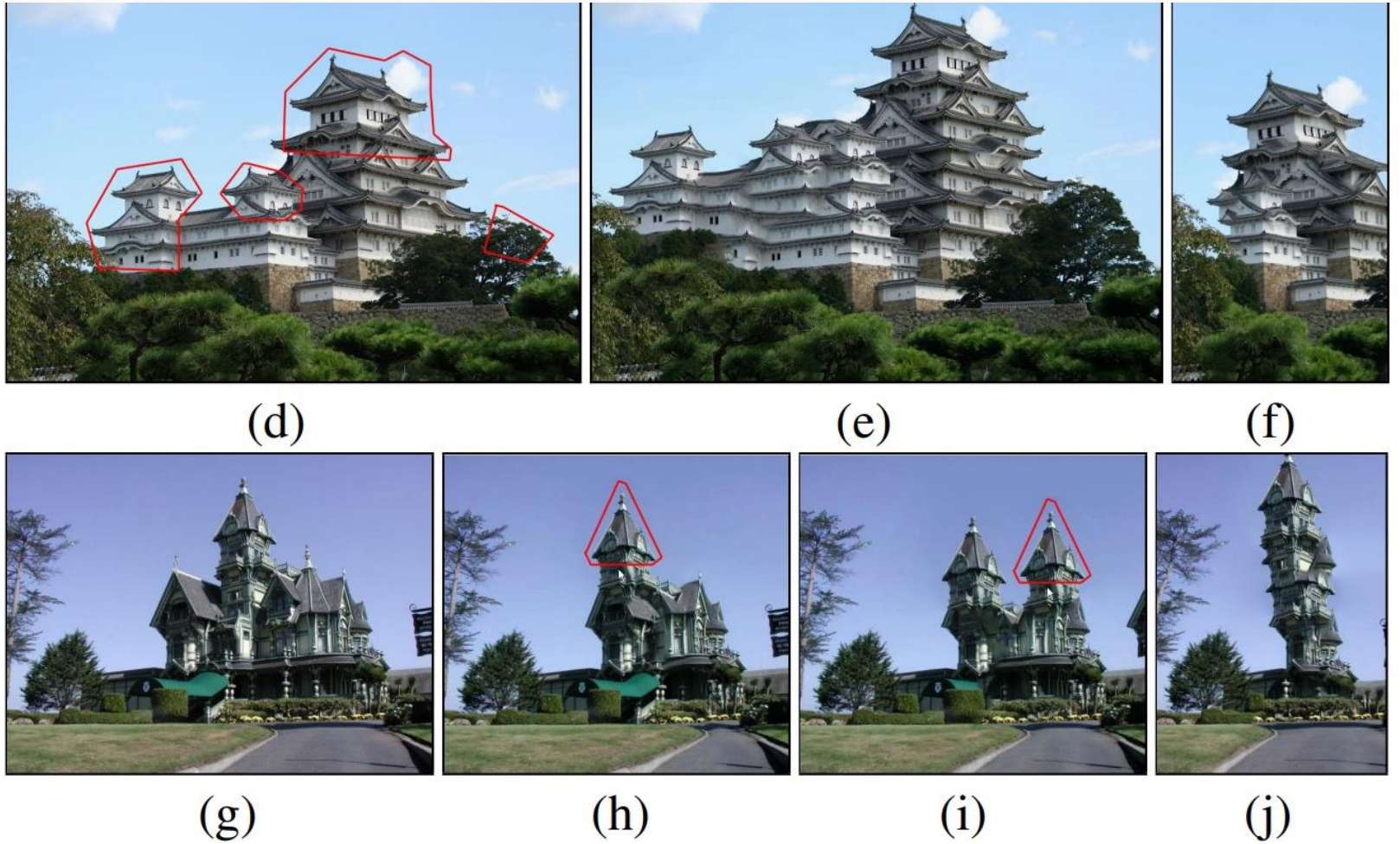
Create realistic new imagery

- Composition

Alpha Matting

Create realistic new imagery

- **PatchMatch [2009]**
  - Completion
  - Reshuffle



Create new artistic imagery

Reference Style

Input Photo

Output Stylized Result

Create new artistic imagery

Reference Style

Input Photo

Output Stylized Result

Create new artistic imagery

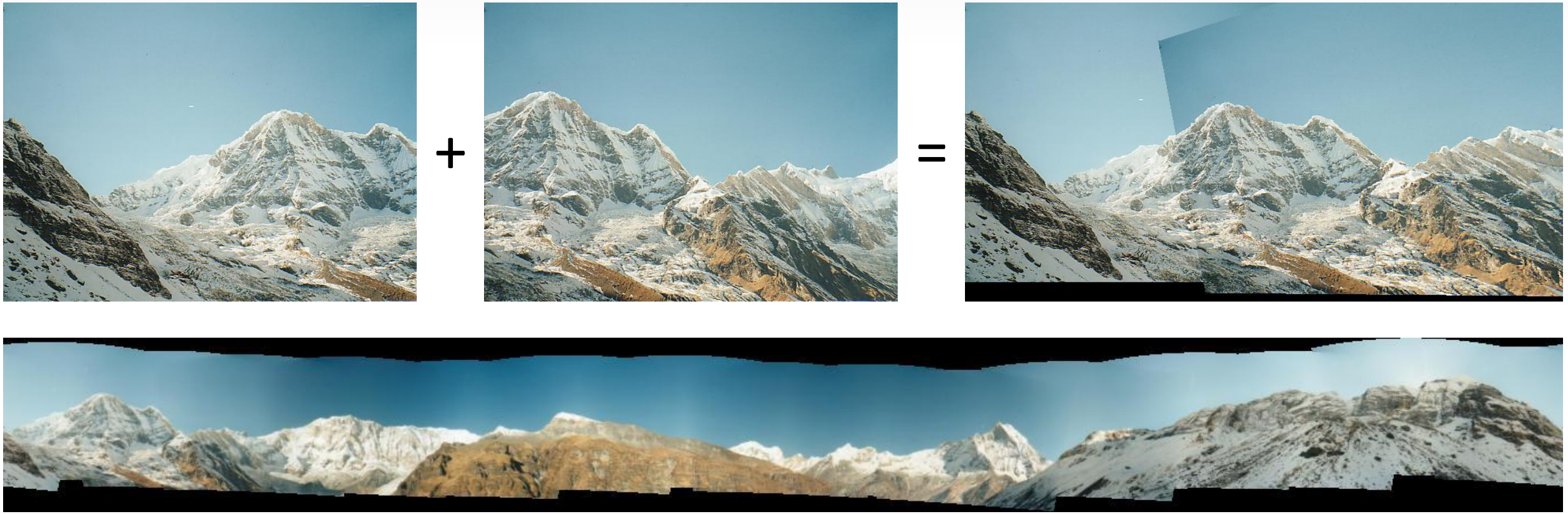
Reference Style

Input Photo

Output Stylized Result

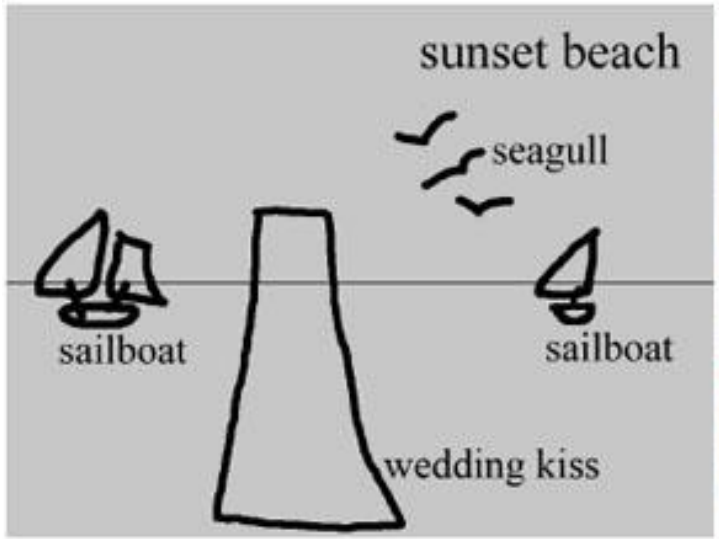
Process image collections

- Stitch images into panoramas



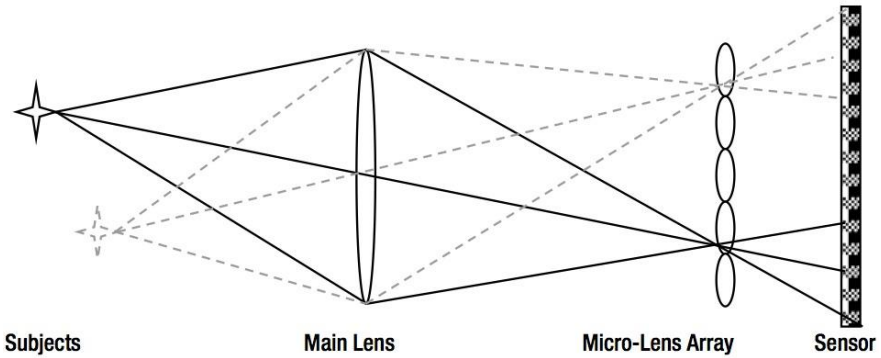
Process image collections

- Sketch2Photo[2009]



Capture more than 2D images

- Lightfield cameras for plenoptic imaging



[Ng et al., SIGGRAPH 2005] [Lytro Inc.]

Capture more than 2D images

Light field imaging enable the capture of richer high-dimensional scene information

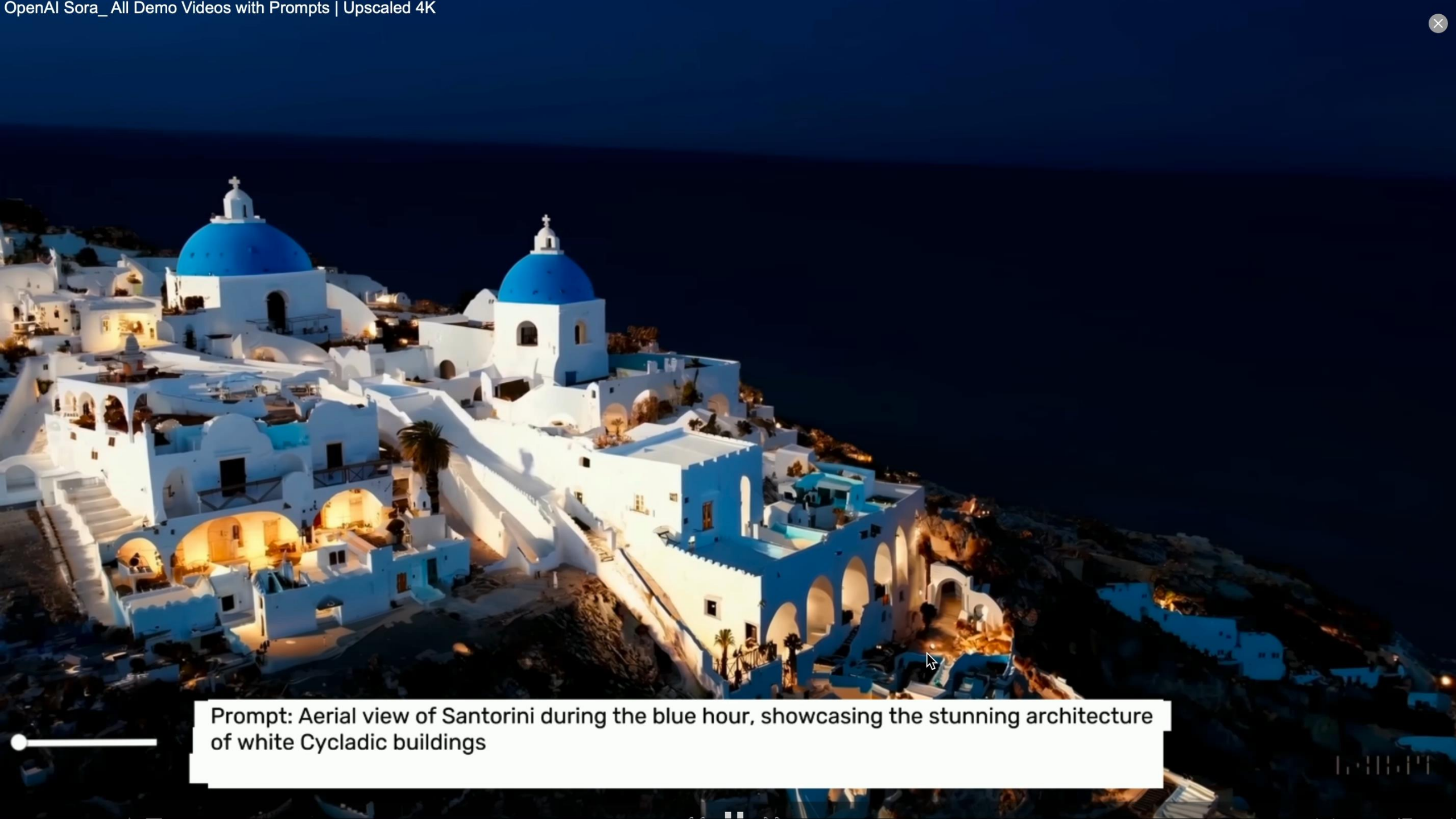
Image Based Rendering

Immersive Light Field Video (SIGGRAPH 2020)

AI-based Generation

- SORA – The newest text-to-video model by OpenAI

OpenAI Sora_ All Demo Videos with Prompts | Upscaled 4K



- **Thanks!**