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Deep Learning Applications for Computer Vision

Lecture 2: Computer Vision Areas - Motion Analysis



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What problems is Computer Vision trying to solve?



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1. Recognition

Does the image contain a certain object/ feature/ activity?

- **Recognize and classify** a certain given object or object class
- **Identify and localize**
- **Detect** a certain specific condition, object



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2. Motion Analysis

2+ images , video

Looking at an *image sequence*:

- Does an object **move** from one image to the next?
- Can we **track** the object and **estimate its motion?** *direction, magnitude*
- What information (**3D information, geometry**) can we gather about the scene, given information about moving objects?



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3. Scene Reconstruction

Tightly coupled with Motion Analysis

- Given **corresponding “features”** in multiple images, can we recover:
 - The camera **pose**
 - The scene **structure** : components, geometry
 - Properties** of the objects in the scene
 - ↳ texture, light, material



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Vision in space



[NASA's Perseverance](#) 2020: panorama including a view of the rover

Vision systems used for several tasks

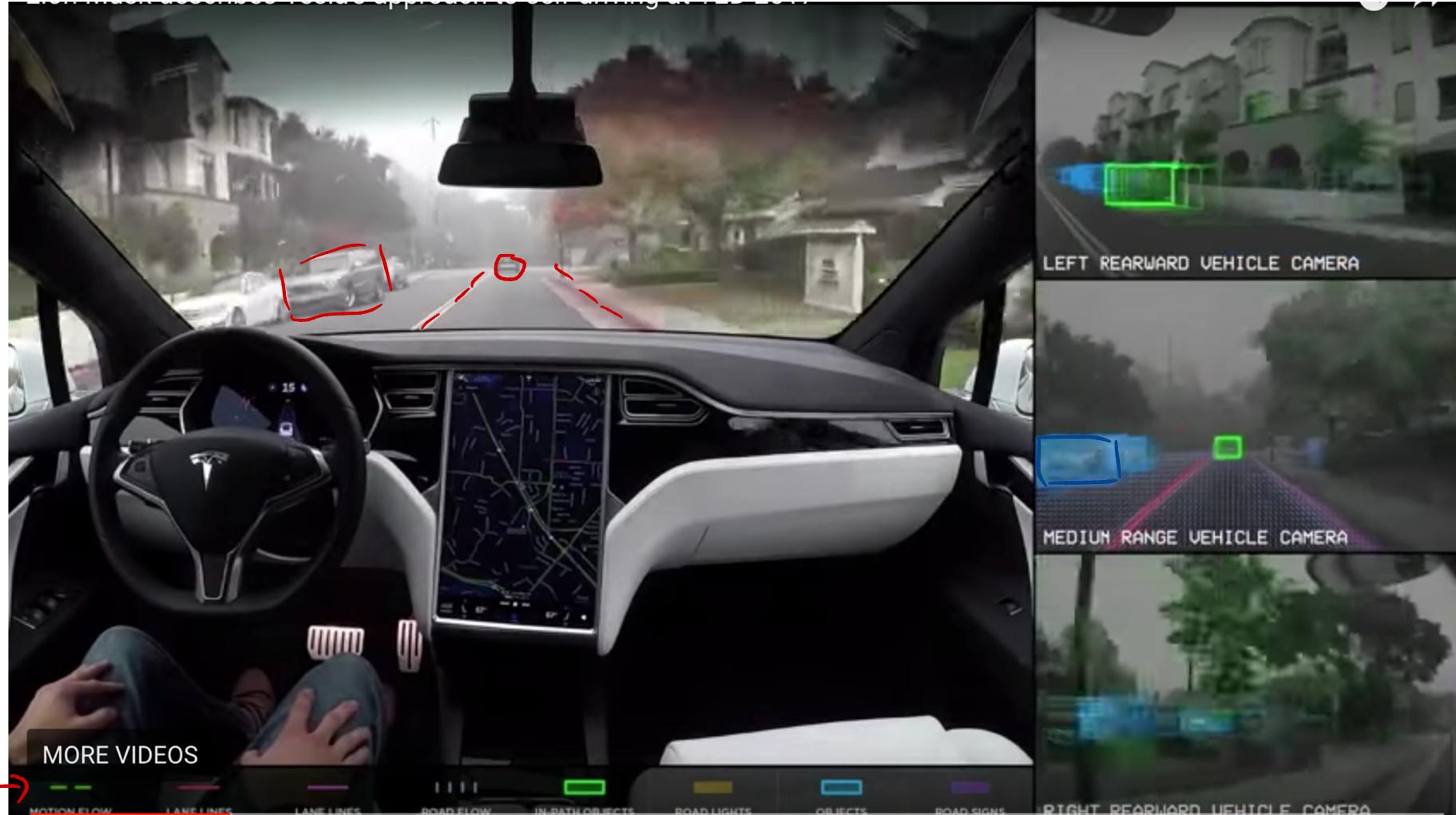
All robots

- Panorama stitching
- 3D terrain modeling
- Obstacle detection, position tracking



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Applications: Autonomous Vehicles



Courtesy of [Tesla Autopilot](#)

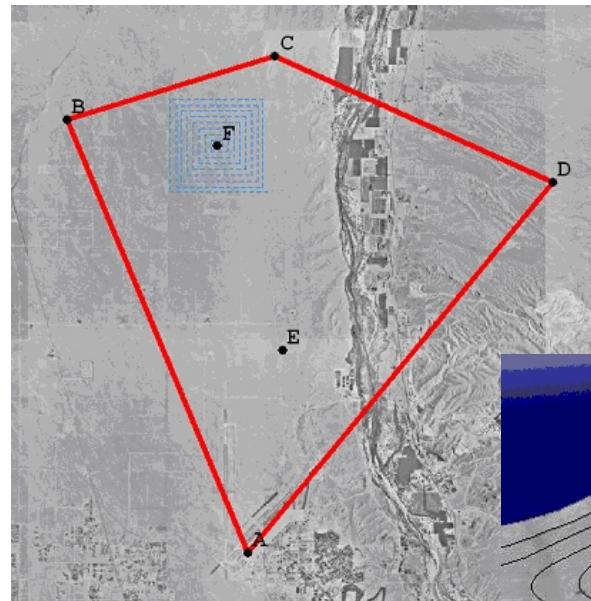


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Applications: Unmanned Aerial Vehicles (UAVs) or drones



Courtesy of Berkeley Robotics
Lab: [Aerobot Team](#)



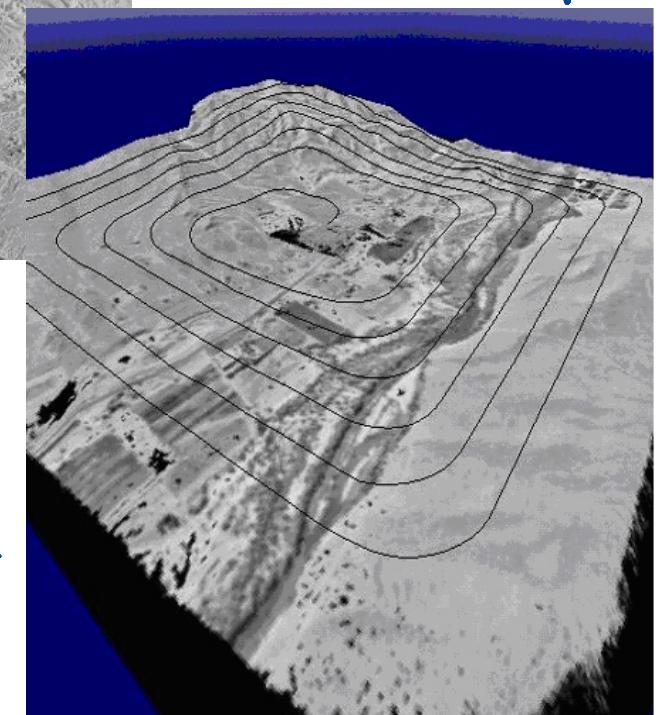
Visual servoing

Terrain map

vision-based
landing



Target



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Motion Analysis – other applications

- Human motion analysis
 - medicine, sports medicine | • tracking
 - Kinesiology | • surveillance
- Manufacturing - high speed cameras
 - assembly lines, robots
 - sports equipment
- Biological Sciences
 - track and count particles / objects / items
 - bees, fireflies

