

University of Colorado  
Boulder

# Deep Learning Applications for Computer Vision

Lecture 2: Computer Vision Areas - Motion Analysis



University of Colorado **Boulder**

# What problems is Computer Vision trying to solve?



University of Colorado **Boulder**

# 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



University of Colorado **Boulder**

## 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?



University of Colorado **Boulder**

# 3. Scene Reconstruction

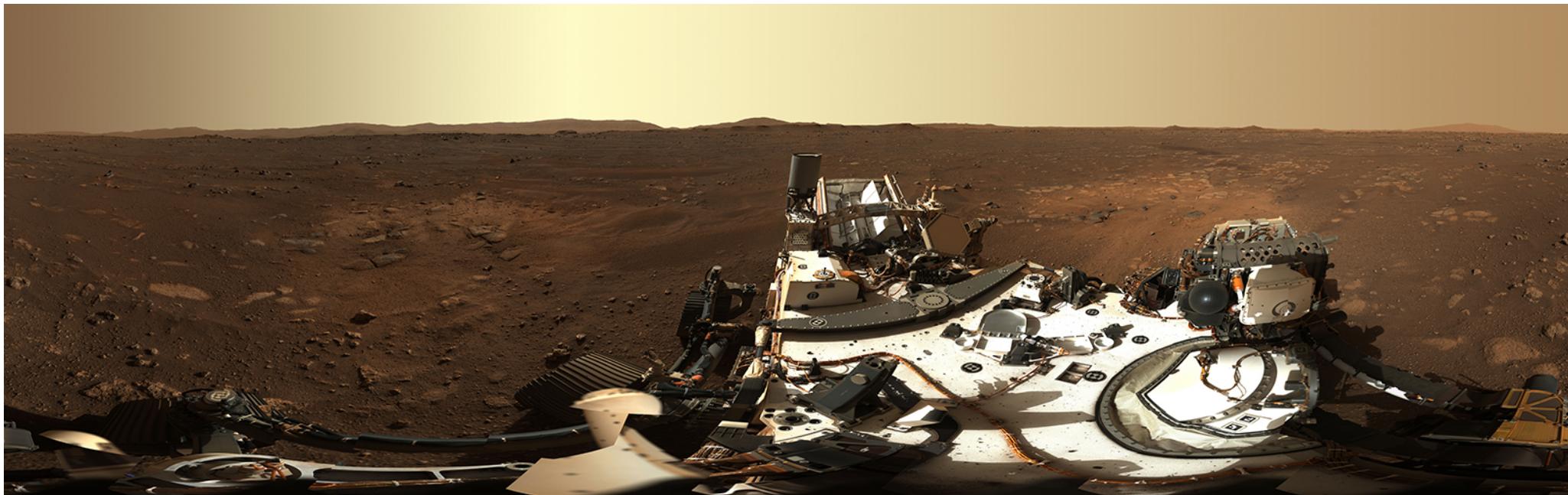
Tightly coupled with Motion Analysis

- 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



University of Colorado **Boulder**

# Vision in space



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

Vision systems used for several tasks

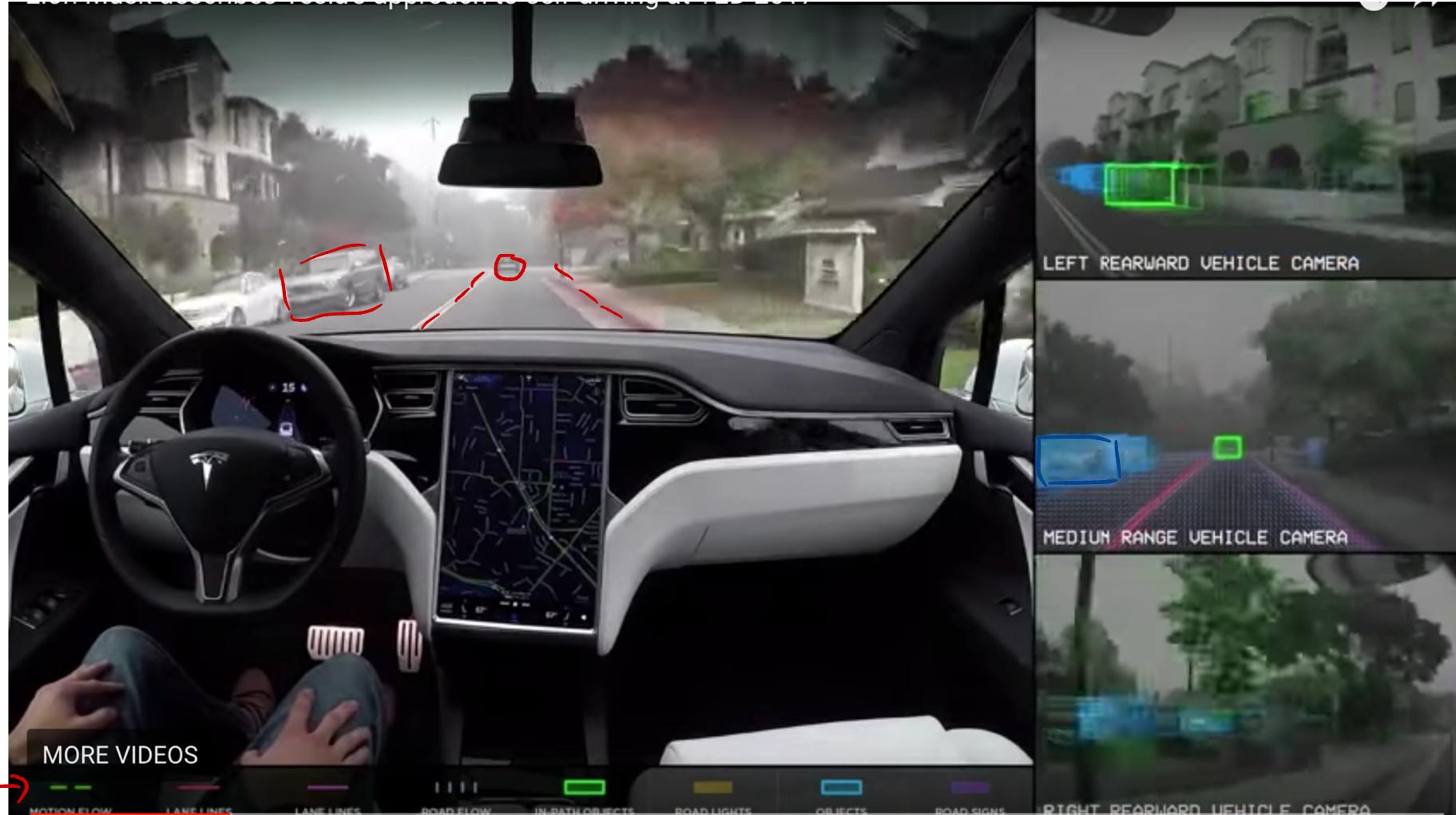
All robots

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



University of Colorado **Boulder**

# Applications: Autonomous Vehicles



Courtesy of [Tesla Autopilot](#)

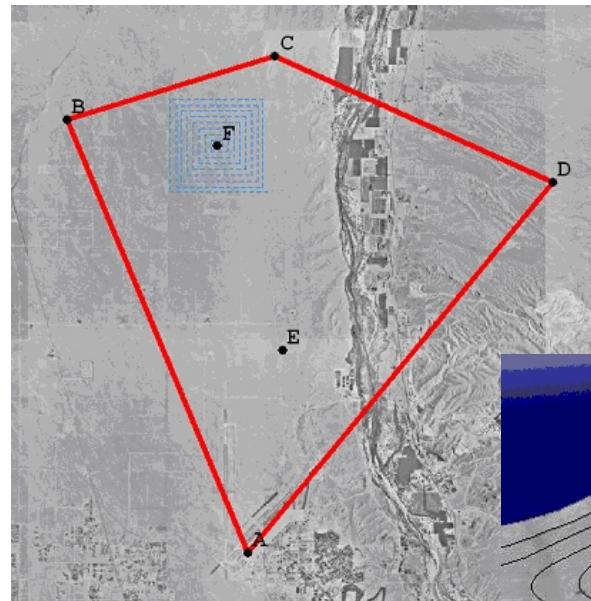


# University of Colorado **Boulder**

# Applications: Unmanned Aerial Vehicles (UAVs) or drones



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



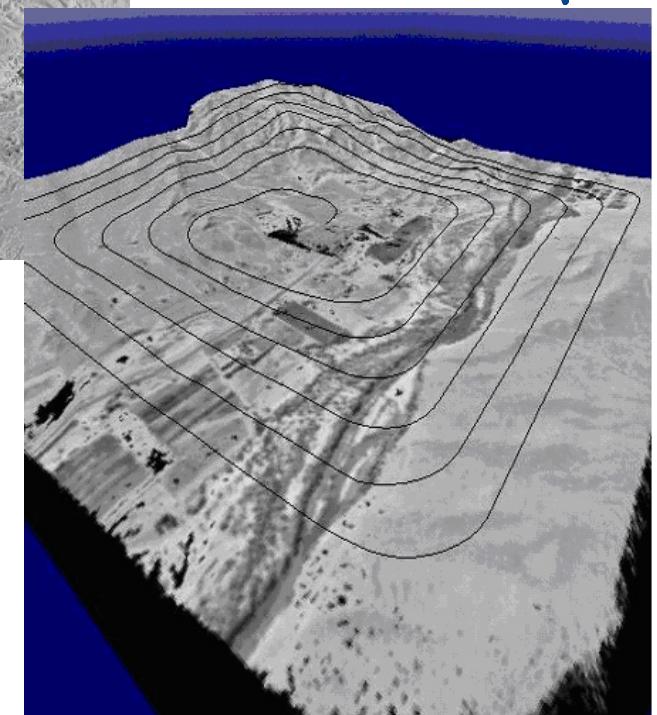
Visual servoing

Terrain map

vision-based  
landing



Target



University of Colorado **Boulder**

# 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

