Applications of Computer Vision

COMPSCI 527

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Interpreting the World
Cameras as eyes

- Main goal: semantic understanding
  - What is going on in the world? What is out there? Who does what?
- Interpretation requires reference to past experience
- Deep learning remembers the statistics of a data set (“past experience”)
- Works well in predictable scenarios, so that the future resembles the past
- Quantitative predictions, if included, are typically approximate
- Correct on average (literally, since training minimizes an average error) and if the future resembles the past
Measuring the World
Cameras as measuring devices

- Main goal: inferring geometry
  - What is where, exactly? What are the 3D shapes of objects?
- Accurate measurements are often needed
  - Examples: quality control, architectural surveys, fitting clothes, virtual models of existing objects or places, …
- Geometry supports inferences based on provable relationships
- Works well in controlled scenarios (known cameras, controlled lighting, …)
- Correct under specific assumptions on scene, imaging, and lighting
- Requires no training data
One System Can Do Both
The line between interpretation and measurement may be blurry

- The Tesla networks recognize vehicle, people, signs, traffic cones…
- They do stereo vision as well
  - Arguably, correspondence is interpretation (x is the same as y)
  - Stereo triangulation is definitely a measurement
- Tesla believes that deep learning will “eat up” all of computer vision
- This may work in a predictable scenario, but likely not when exact measurements are the main goal
- In measurement, we want accuracy, not just plausibility given a data set
- Systems of the two types are likely to continue to coexist
• Andrej Karpathy: AI for Full-Self Driving at Tesla
  https://www.youtube.com/watch?v=hx7BXih7zx8

• Dronegenuity: Aerial Photogrammetry Explained
  Create 3D models with Drone Photos
  https://www.youtube.com/watch?v=Blr3suSQ-t-Q

• School of Motion: Getting Started with Photogrammetry
  Using Your Cell Phone
  https://www.youtube.com/watch?v=ZlW4XU6Wm8Q

• Capturing Reality: Urban Photogrammetry
  Steps Cottage by 3 Pivot
  https://www.youtube.com/watch?v=E17XQdC3DVU