

Applications of Computer Vision

COMPSCI 527

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

Video Credits

Downloaded from YouTube on 4/20/2021

- *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=Blr3suSQt-Q>
- *School of Motion: Getting Started with Photogrammetry*
Using Your Cell Phone
<https://www.youtube.com/watch?v=ZIW4XU6Wm8Q>
- *Capturing Reality: Urban Photogrammetry*
Steps Cottage by 3 Pivot
<https://www.youtube.com/watch?v=E17XQdC3DVU>