18-799: Applied Computer Vision

Spring 2026

Course Logistics

Carnegie Mellon University
Africa

Objectives

In today's class we will learn

- **General Motivation**
- **Course Logistics**

Course Information

- Instructors
  - Moise Busogi
  - Assane Gueye
- Teaching Assistants:
  - Miracle James (Office Hours: TBD)
  - Joel Adebayo (Office Hours: TBD)
  - Eleanor Wepngong (Office Hours: TBD)

Every picture tells a story

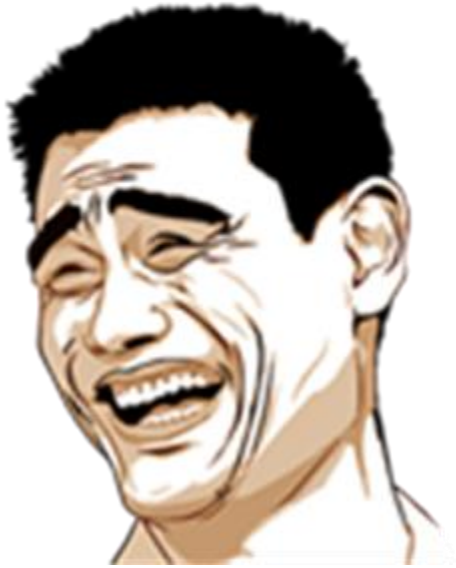
Goal of computer vision is to write computer programs that can interpret images

Slide by Szeliski, *Richard*

Every picture tells a story

https://nypost.com/2018/06/26/exhausted-doctors-are-putting-patients-in-danger/

Every picture tells a story

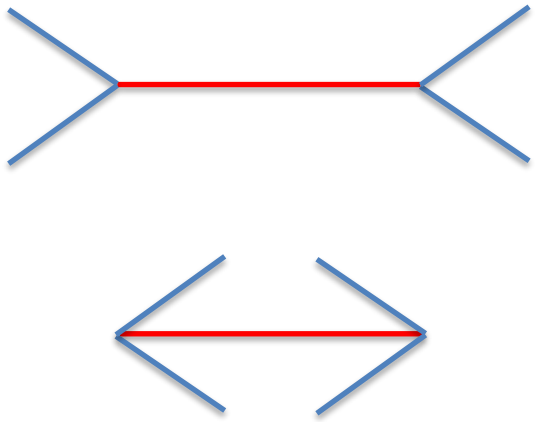


Every picture tells a story

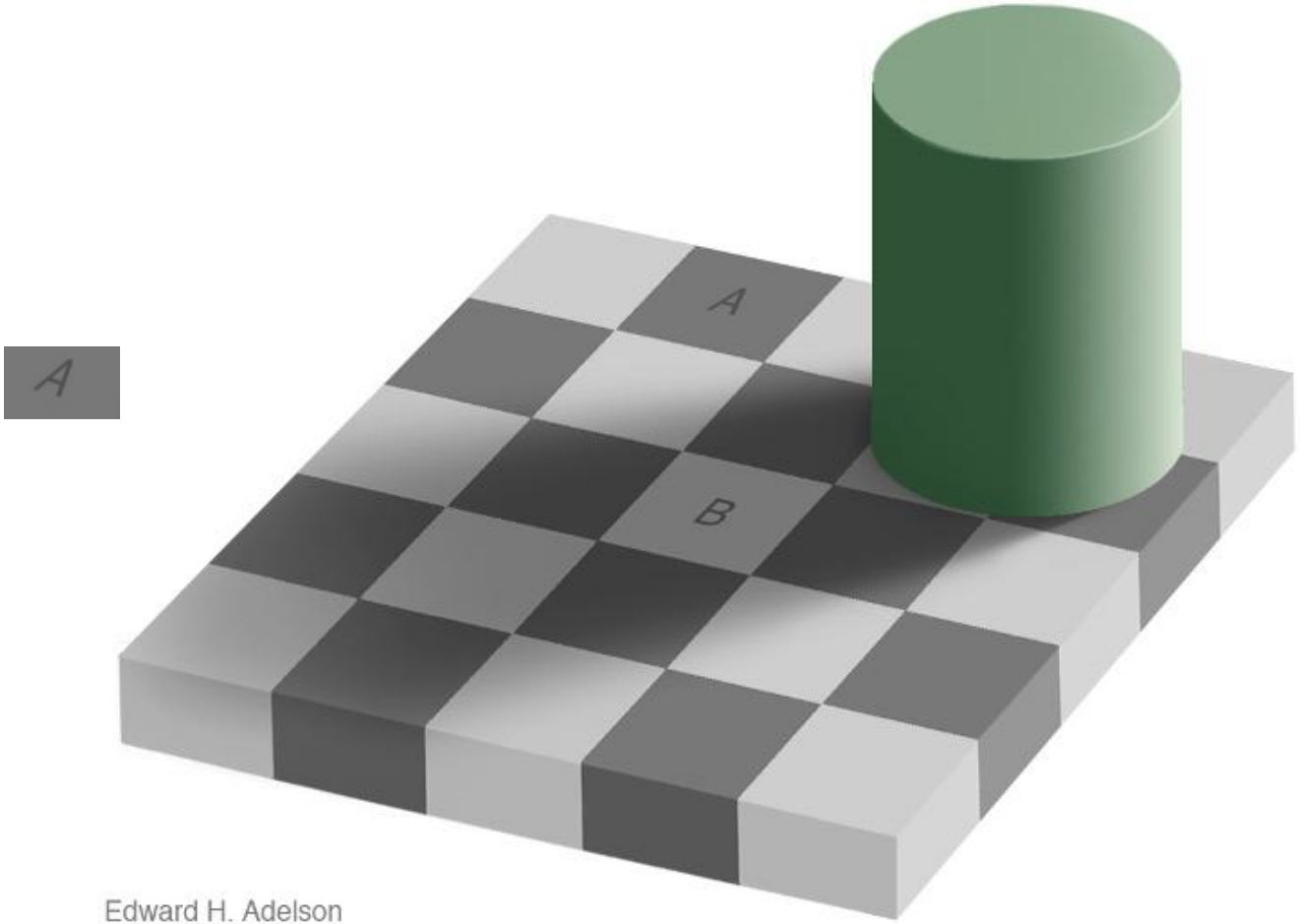
- Perspective versus truth

https://share.google/images/y1DP9uB2tdqaI2nP2

Optical Illusion

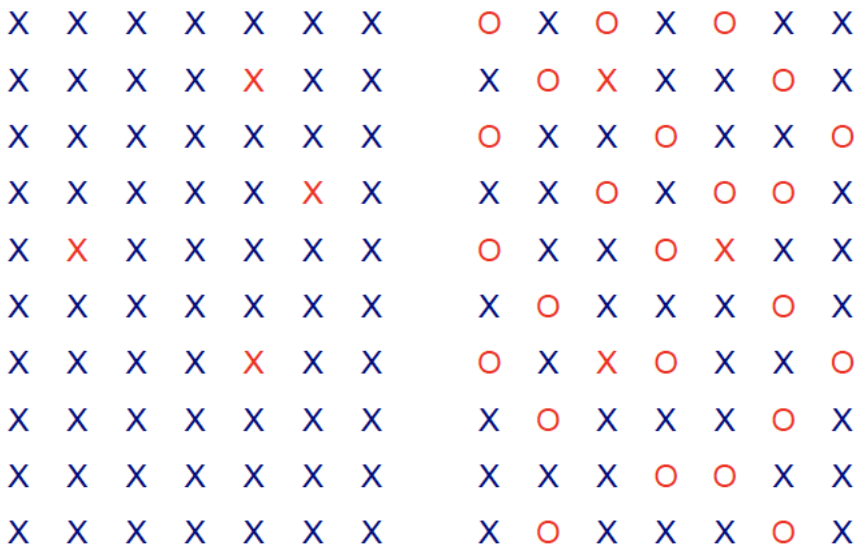


Optical Illusion

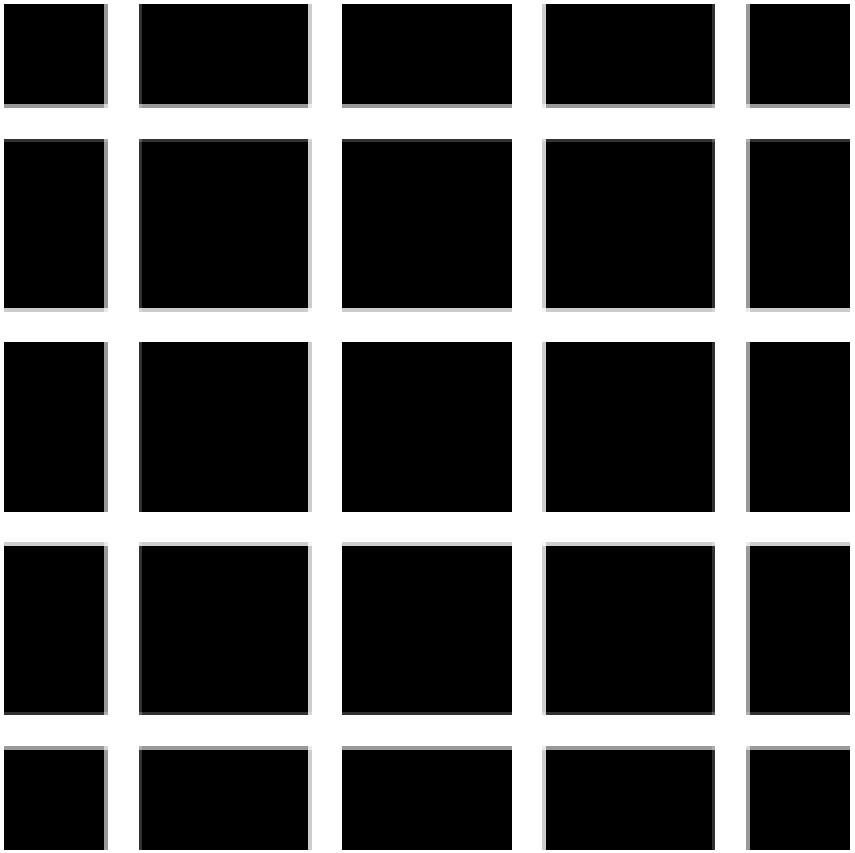


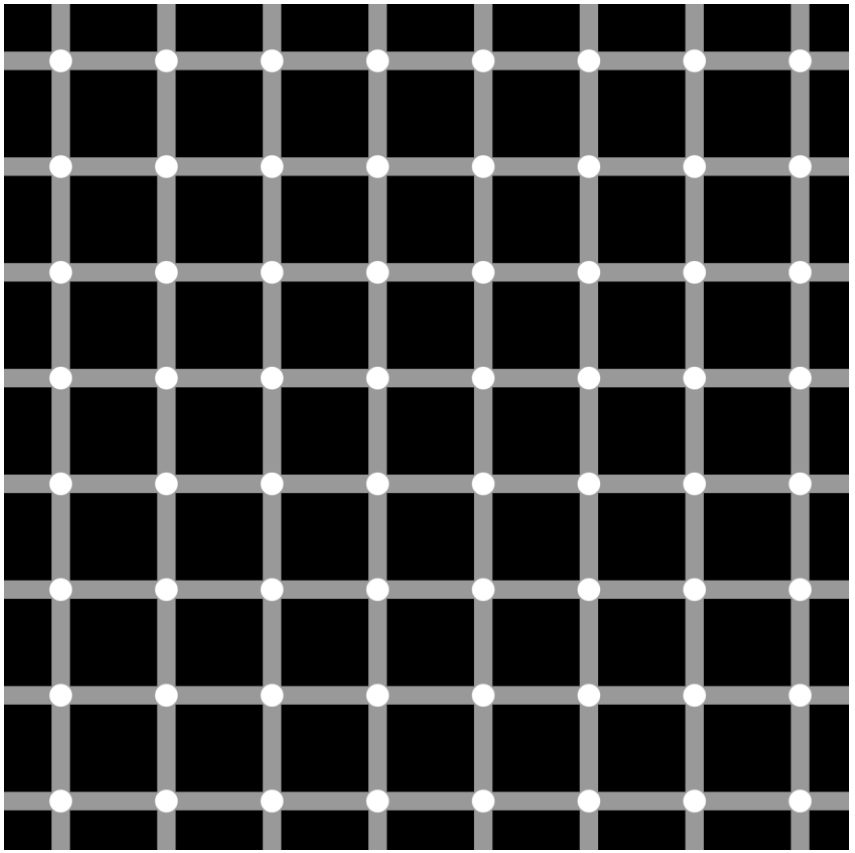
Edward H. Adelson

Optical Illusion



Optical Illusion





Computer Vision

- In computer vision, we are describing the world that we see in one or more images
- Reconstruct its properties, such as shape, illumination, and color distributions.

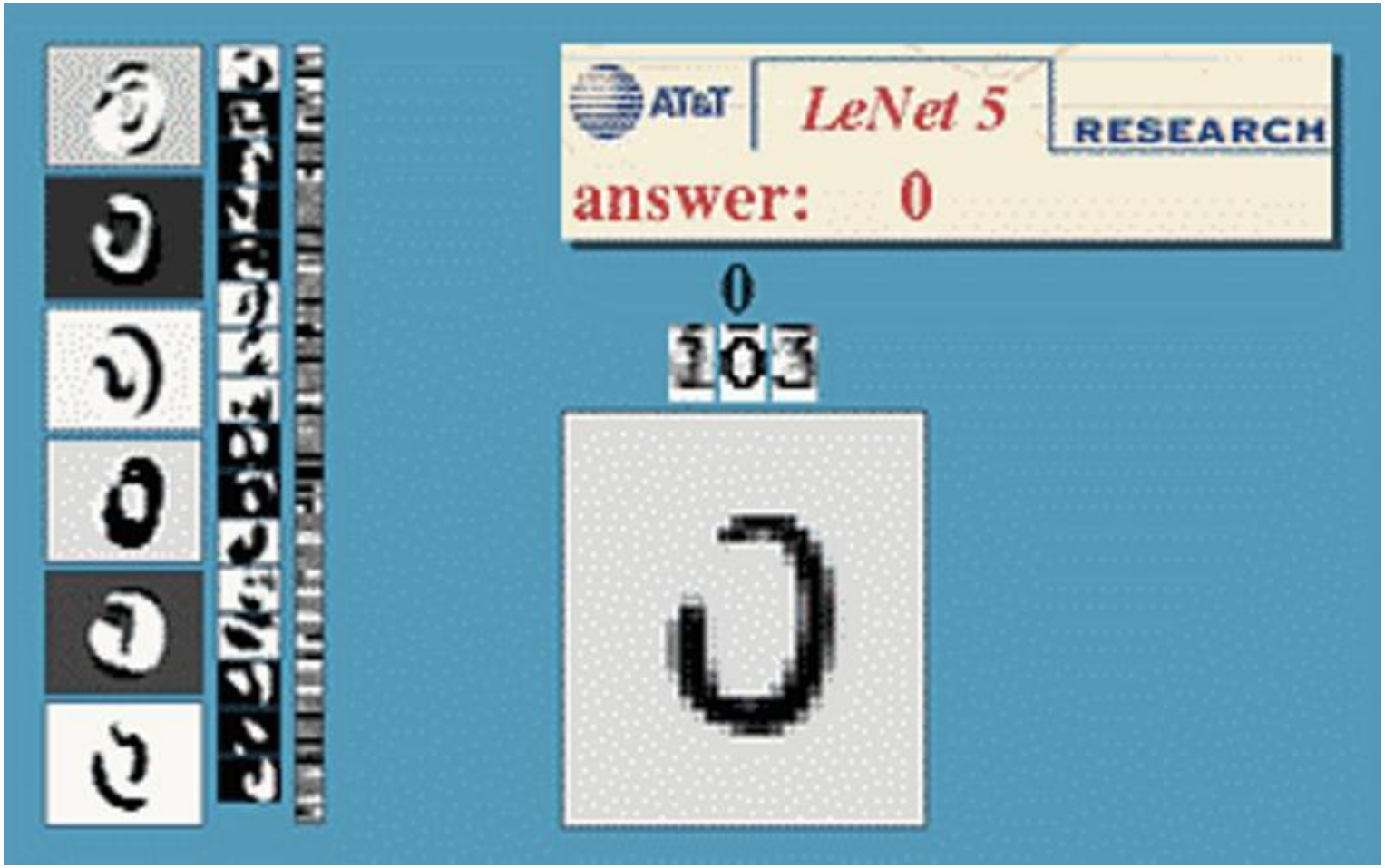
What is computer Vision

- **Computer Vision** studies how machines acquire, process, and interpret visual information from images and videos.

- It combines geometry, physics, statistics, and machine learning to extract meaning from visual data.
- pixels ⟶ representations ⟶ decisions

Slide by Szeliski, *Richard*

CV Applications

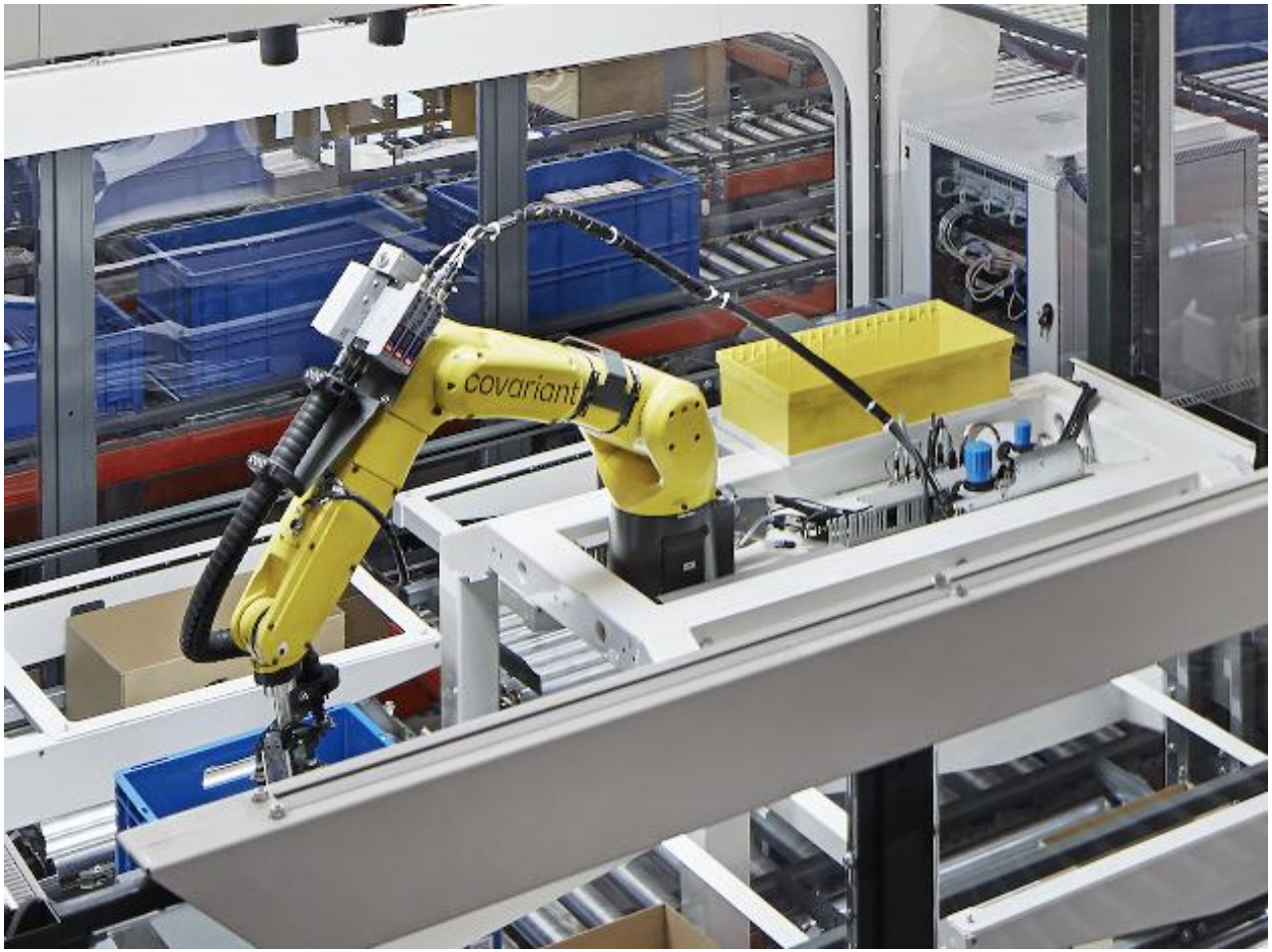


Optical character recognition (OCR),http://yann.lecun.com/exdb/lenet

CV Applications

Mechanical inspection, http://www.cognitens.com;

CV Applications



Warehouse picking,https://covariant.ai

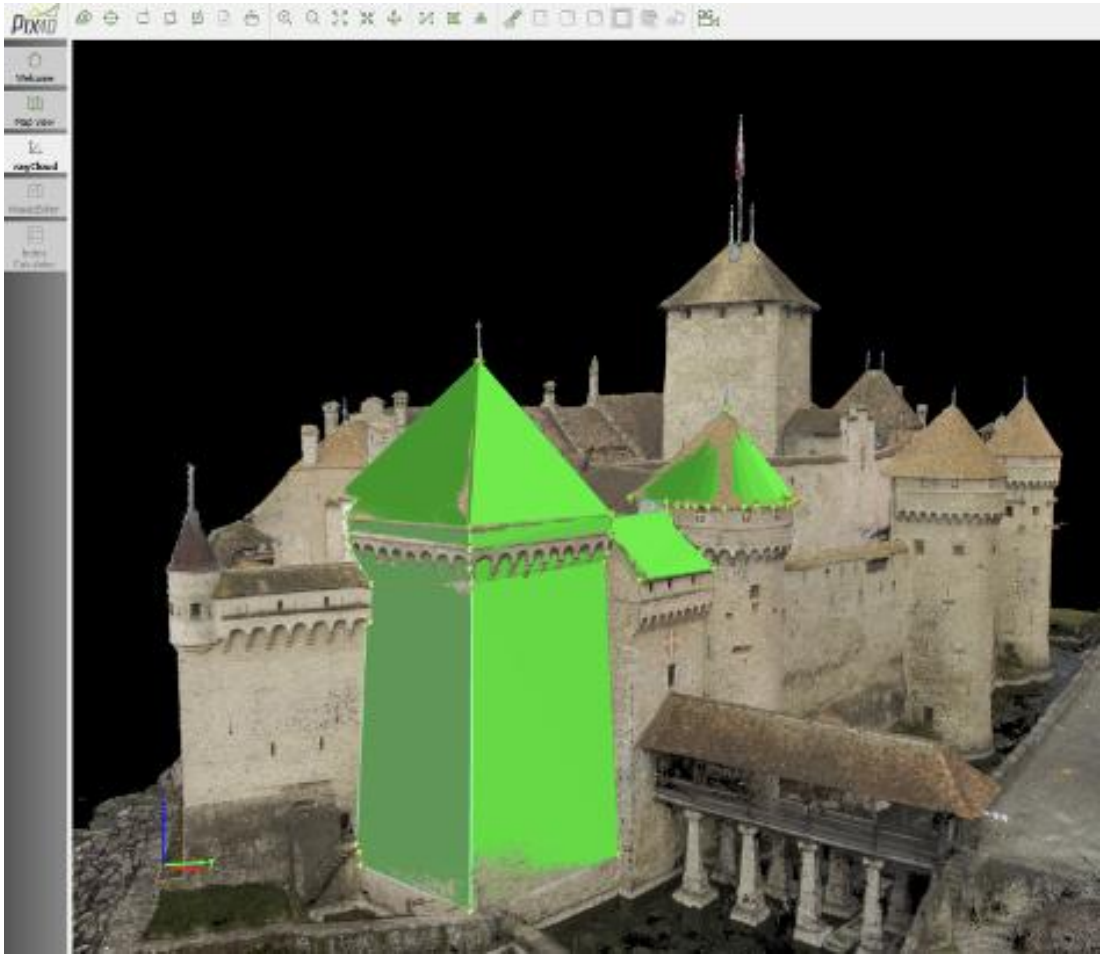
CV Applications

Medical imaging, http://www.clarontech.com

CV Applications

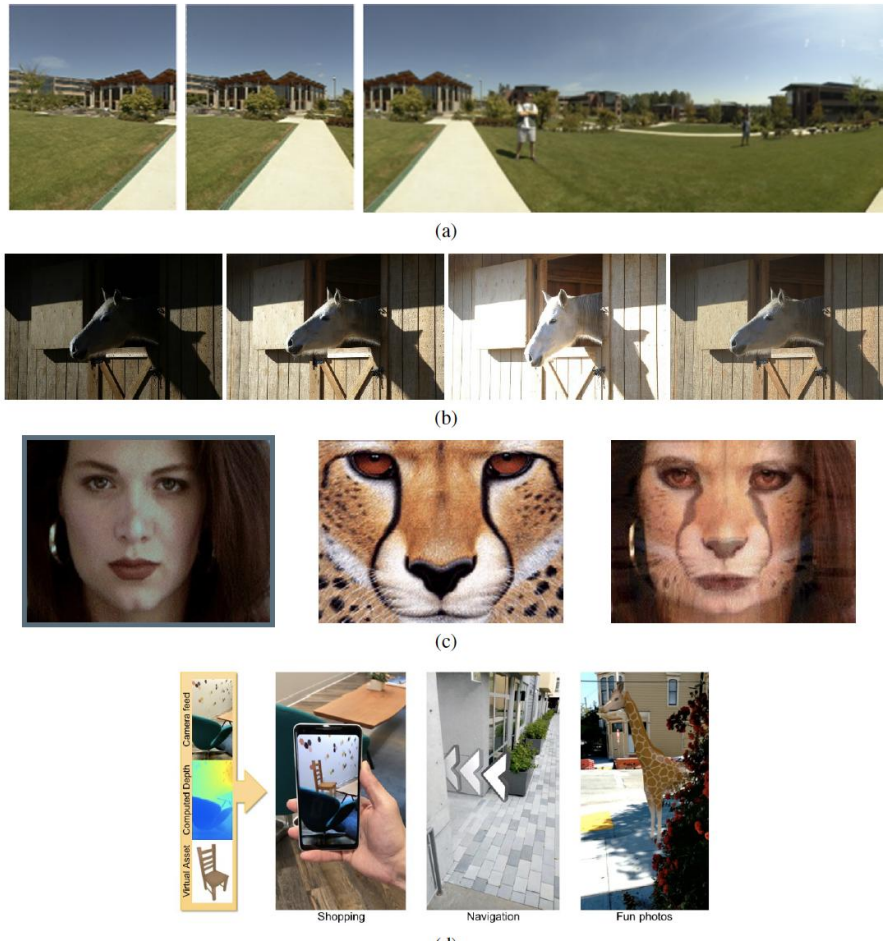
Self-driving cars, (Montemerlo, Becker et al. 2008) © 2008 Wiley

CV Applications



Drone-based photogrammetry, https://www.pix4d.com/blog/mapping-chillon-castle-with-drone.

CV Applications



Some consumer applications of computer vision:

- (a) image stitching: merging different views (Szeliski and Shum 1997) © 1997 ACM;
- (b) exposure bracketing: merging different exposures;
- (c) morphing: blending between two photographs (Gomes, Darsa et al. 1999) © 1999 Morgan Kaufmann;
- (d) smartphone augmented reality showing real-time depth occlusion effects (Valentin, Kowdle et al. 2018) © 2018 ACM

Learning Outcomes

- By the end of the course, students will be able to:
- Explain and apply camera models and geometric principles underlying image formation.
- Use digital image processing techniques to extract meaningful visual information.
- Implement feature-based and classical machine learning methods for visual recognition tasks.
- Train and analyze deep learning models, including convolutional and transformer-based architectures, for vision applications.
- Construct and interpret 3D vision pipelines for spatial understanding and reconstruction.

Class Policies

- You are expected to **attend every class**; if you need to miss a lecture because of a medical emergency or something equally significant, please let the instructor know by email before the lecture (if applicable).

- There will be **no make-up** quizzes or exams.

Homework Policies

- Students are encouraged to discuss homework problems with classmates, teaching assistants, and the instructor.
- Such collaboration must be limited to clarifying the problem and discussing high-level solution strategies.
- All submitted work must be produced independently by the student and written in their own words. Solutions may not be copied from any person, online source, or prior coursework.
- Copying another student's homework or exam, or allowing one's own work to be copied, constitutes academic dishonesty and will be treated as cheating.
- If there is any uncertainty about whether a particular activity or form of assistance is permitted, students are expected to consult the instructor in advance.
- Each student is granted a total of **three slack days** for the term, with **no more than one slack day allowed per assignment**. Slack days must be used explicitly and are intended for unforeseen circumstances.
- Homework assignments must be submitted by the stated deadlines. Late submissions will not be accepted except through the use of approved slack days.

Project Policy

- As part of exploring real-world applications of computer vision, the course requires a **semester-long project**.
- Projects must go **beyond theory** and address a **practical, real-world problem**.
- Students will work in **teams of four**.
- Choose a project that **sparks your curiosity** and **aligns with your interests and passions**.

Project Policy

- **Problem Selection**
  Choose a meaningful, real-world problem that motivates your project.
- **Teamwork**
  Work in teams of four. Collaborate effectively, leverage diverse strengths, and communicate clearly.
- **Project Execution**
  Research existing approaches, explore datasets, and design a solution with a clear end goal.
- **Demonstration**
  Every project must include a live or recorded demo. A project is not complete without showing it in action.
- **Peer Review**
  Projects will be reviewed by classmates. Be open to feedback and use it to improve your work.
- **Novelty & Deployment**
  Novelty and Physical or system-level deployment are strongly encouraged (e.g., cameras, embedded devices, robots, sensors, actuators).
- **Grading**
  Evaluation is based on a combination of peer reviews and instructor assessment, with emphasis on originality, execution, and demonstration quality.

Recitation & Labs

- There will be at least one-hour recitation/lab every week

- Recitation/lab attendance is not mandatory, but is extremely valuable

Grading Policy

- Final letter grade will depend on the following components
  - Weekly Quizzes: 20% (In-person) [Drop the lowest score]
  - Mid-Semester Exam: 20%
  - Assignments: 25%
  - Group Project: 30%
  - Participation: 5%
- Following thresholds will be used for grading
  - Grade As: 90% and above
  - Grade Bs: 80% to 89.99%
  - Grade Cs: 70% to 79.99%
  - Grade Ds: 60% to 69.99%
  - Grade R: 59.99% and below

Take care of yourself

- Do your best to maintain a healthy lifestyle this semester
  - by eating well,
  - exercising,
  - avoiding drugs and alcohol,
  - getting enough sleep and
  - taking some time to relax.
- This will help you achieve your goals and cope with stress.
- All of us benefit from support during times of struggle. You are not alone.
- There are many helpful resources available on campus and an important part of
- The college experience is learning how to ask for help.
- Asking for support sooner rather than later is often helpful. call 0788503528 (Solid Minds) and visit CaPS website at http://www.cmu.edu/counseling/.
- Consider reaching out to a friend, faculty or family member you trust for help