Getting Started

Objectives

- What is computer vision?
- Where are the computer vision apply to?
- What are the challenges of computer vision?
- The future of computer vision?

What is computer vision

Computer Vision is a field of computer science that enables the computer to understand just like a human.

What are objects in the image?

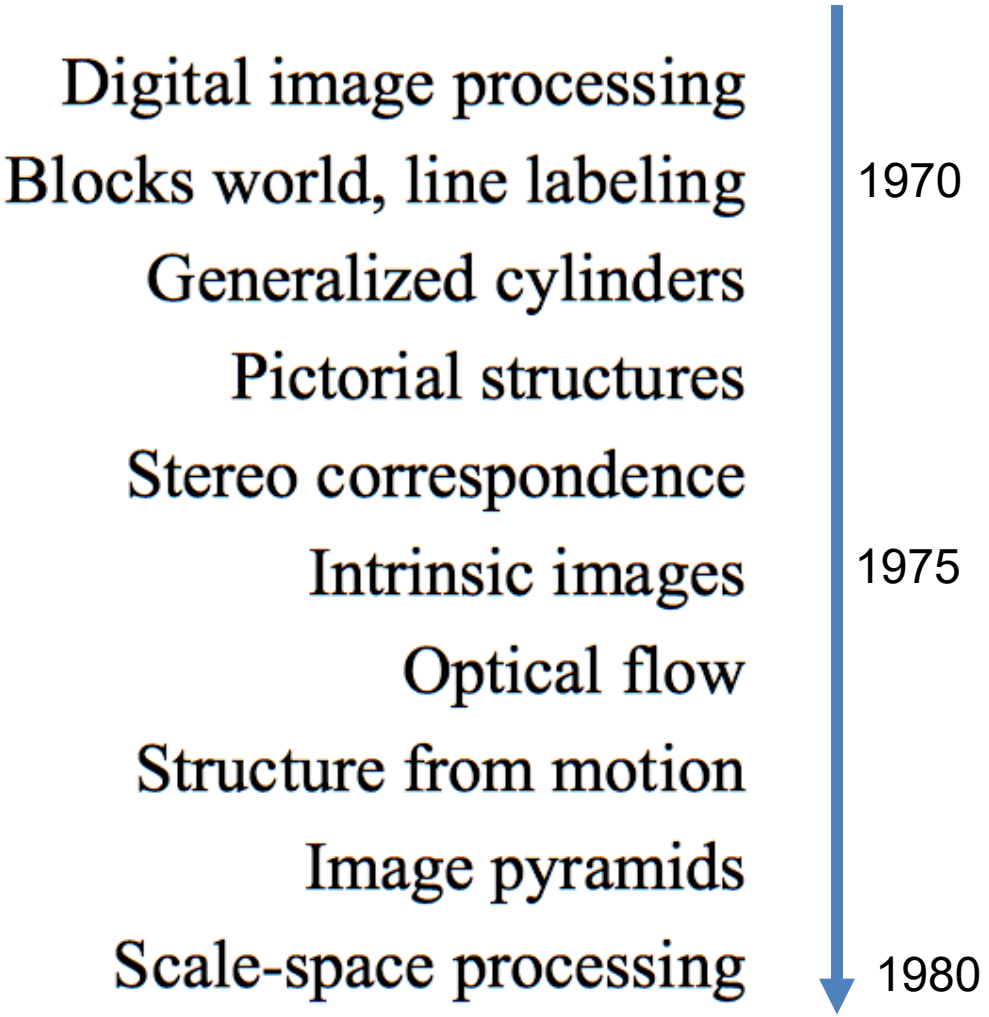
How many trees are there in the picture?

What color is the sky?

Did You Know That We Perceive 80% Of All Impressions Using Our Sight?

https://bettersightvisioncenter.com/did-you-know-that-we-perceive-80-of-all-impressions-using-our-sight/

History of computer vision



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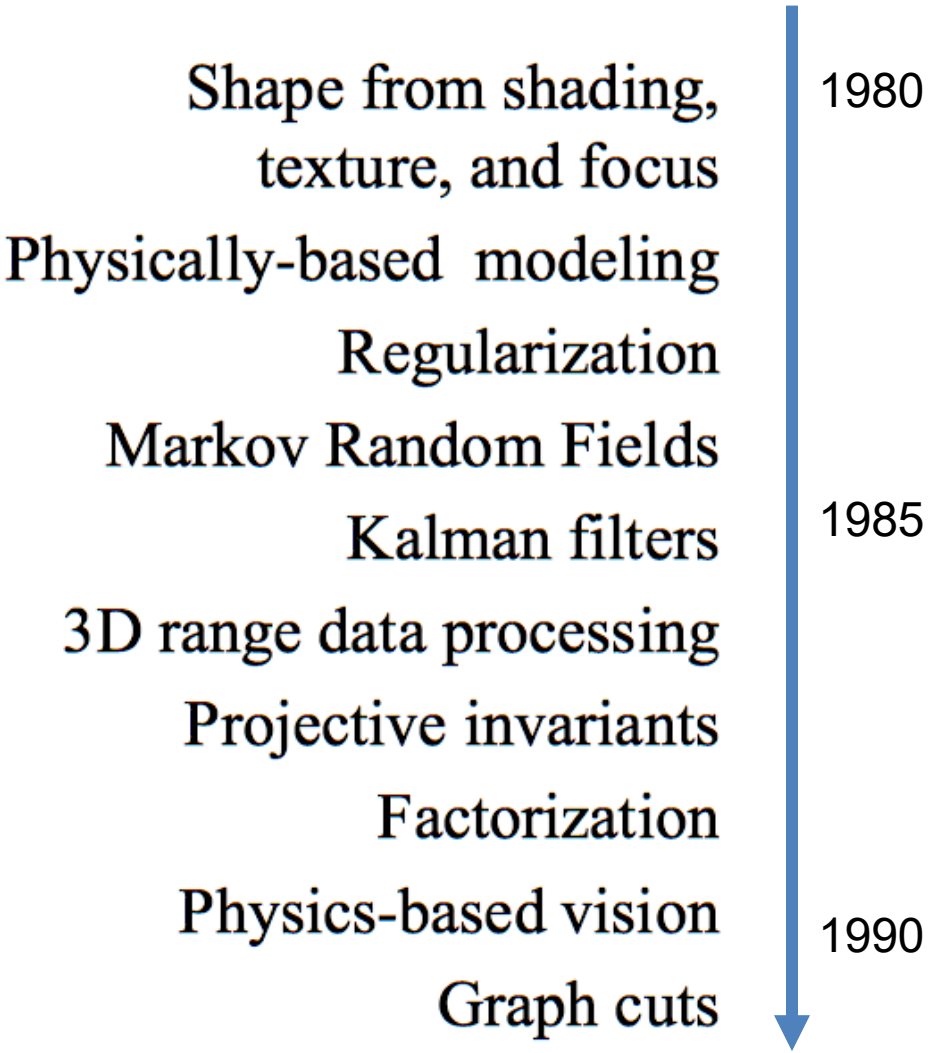

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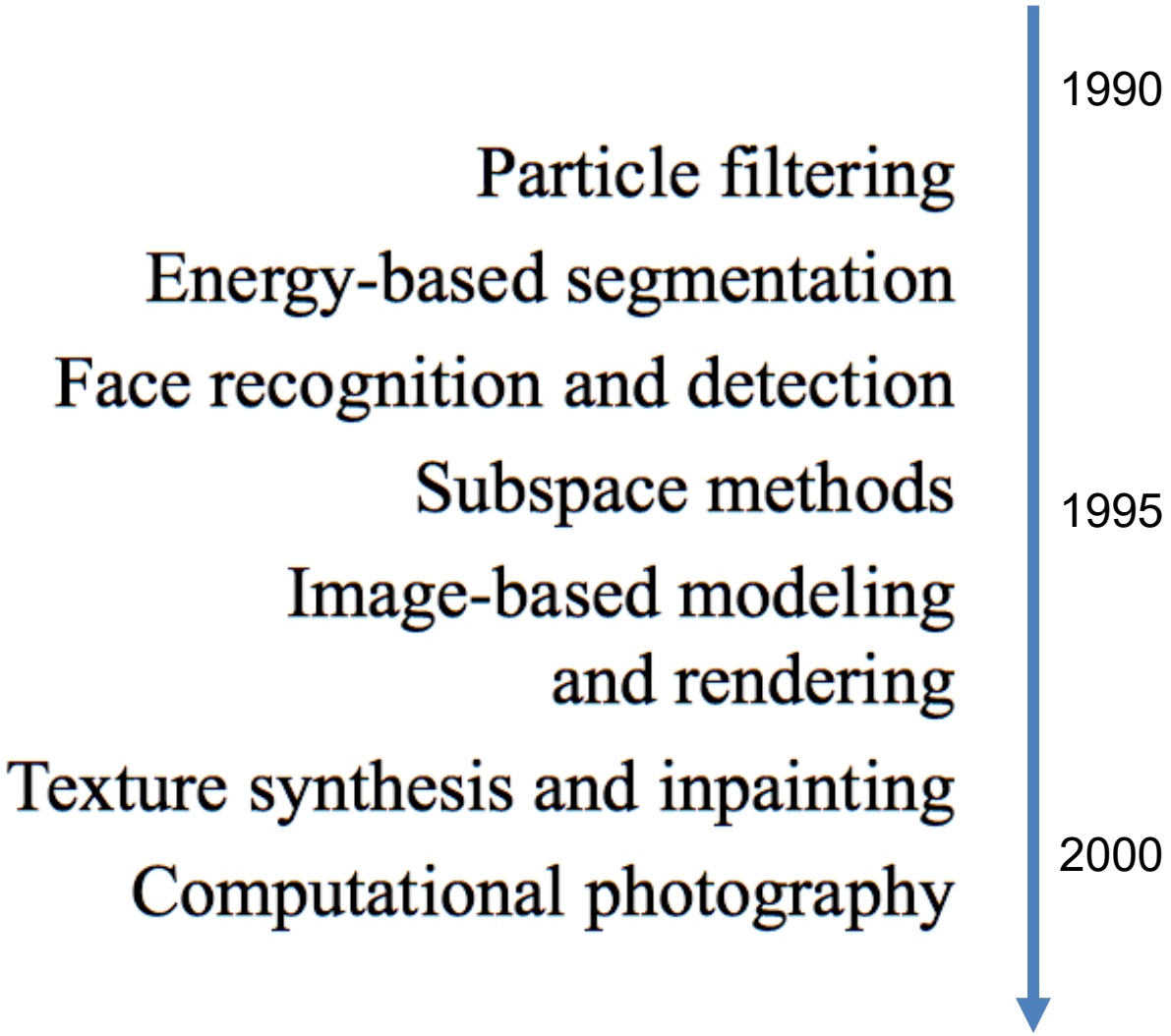

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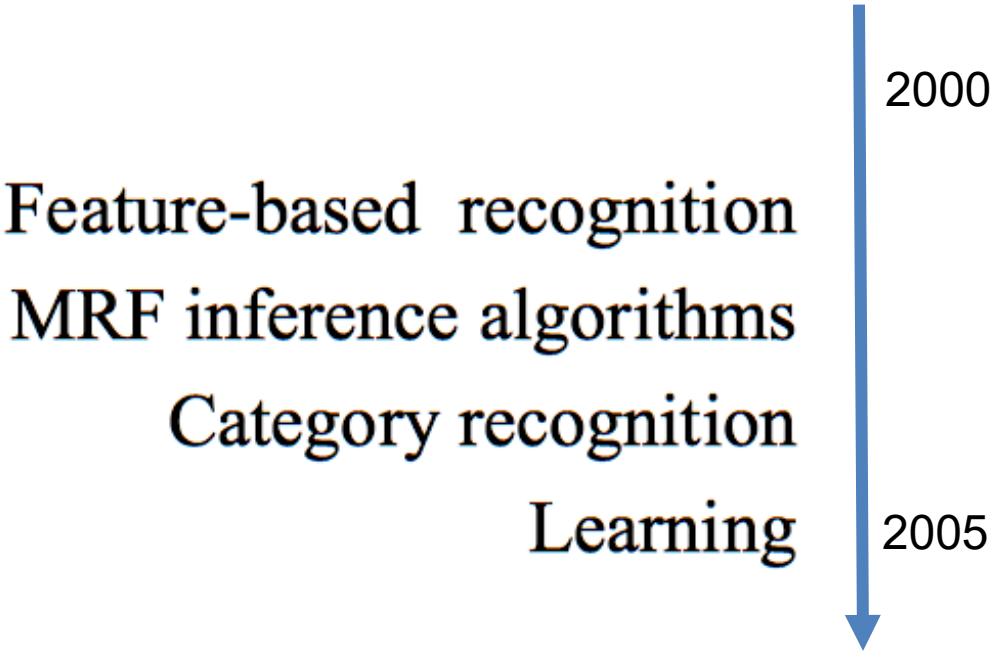
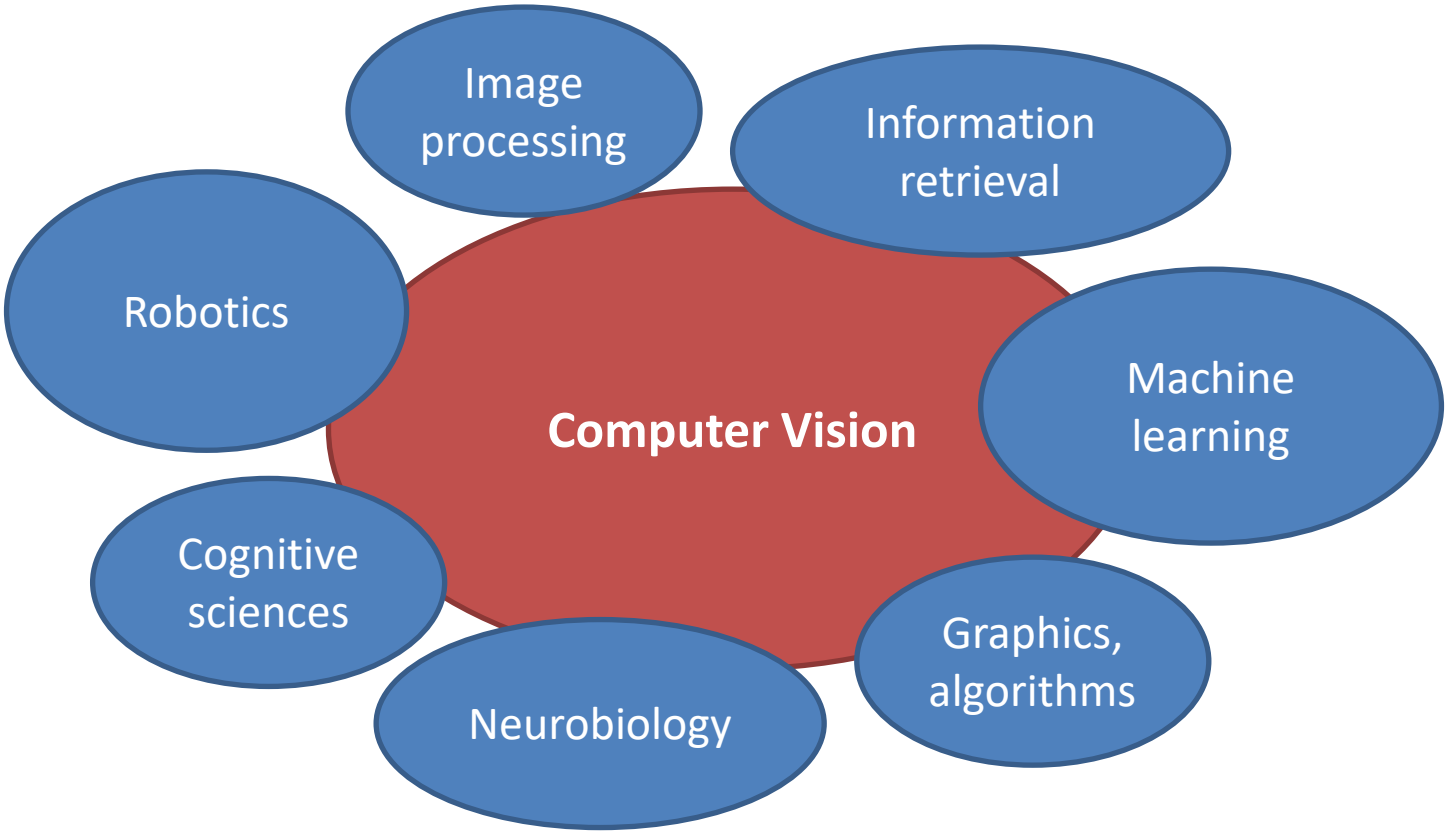
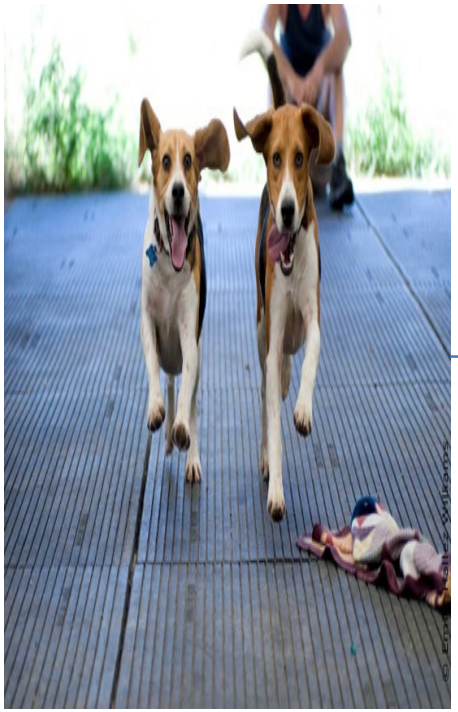
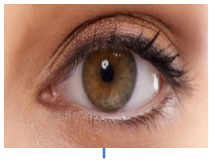


The related fields



The Vision: Human & Computer



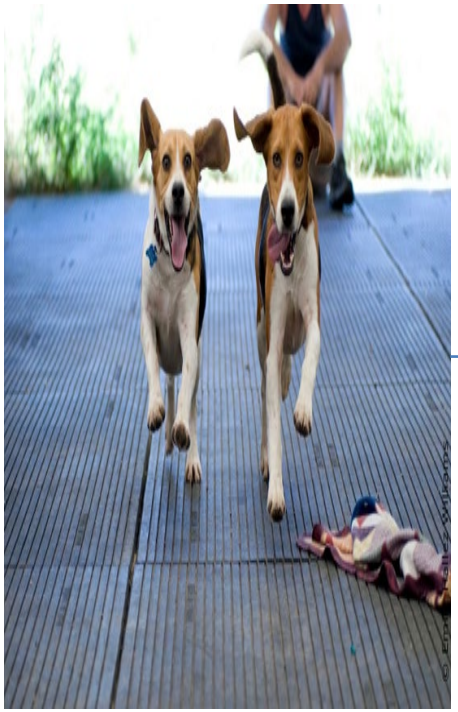


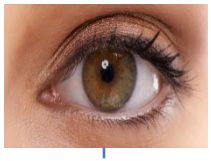
Sensing

Interpreting

Human, dog, happy, run, etc

The Human Vision





Sensing

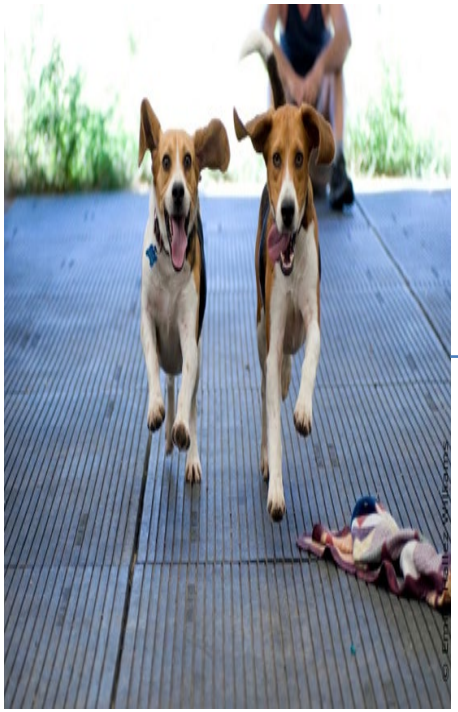
Interpreting

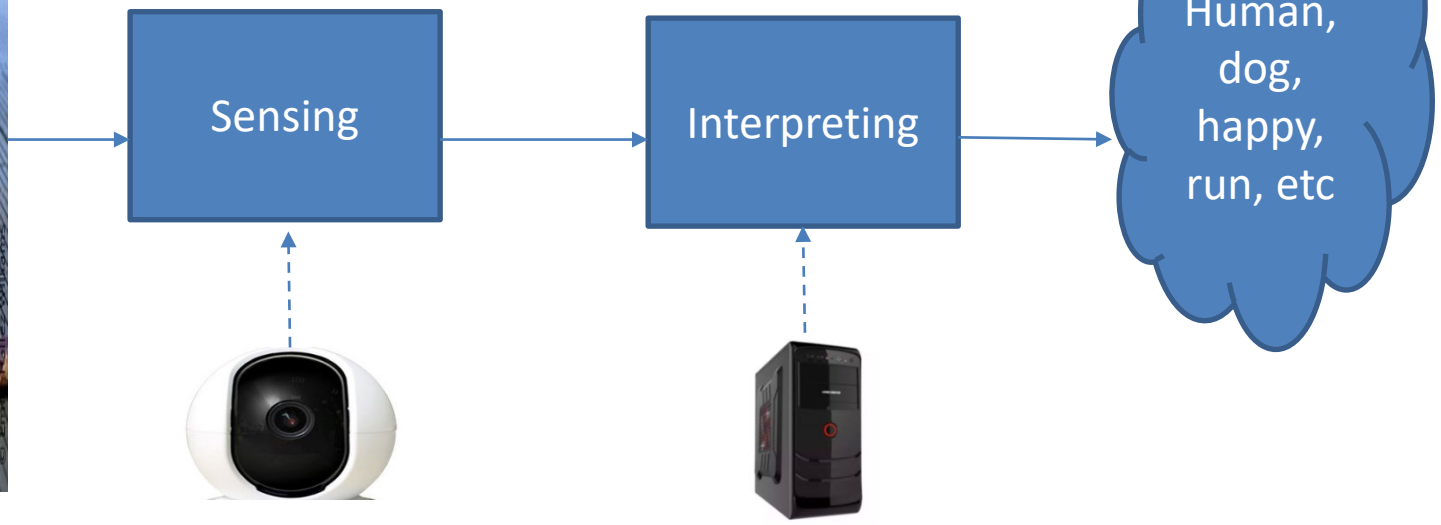
Human, dog, happy, run, etc

- Loss memory
- Dependency
- Huge data→ slow

The Computer Vision

- Transfer learning
- Fair
- Huge data→ Fast





The goal of computer vision

Perceive the “story” behind the picture

You see

0	3	2	5	4	7	6	9	8
3	0	1	2	3	4	5	6	7
2	1	0	3	2	5	4	7	6
5	2	3	0	1	2	3	4	5
4	3	2	1	0	3	2	5	4
7	4	5	2	3	0	1	2	3
6	5	4	3	2	1	0	3	2
9	6	7	4	5	2	3	0	1
8	7	6	5	4	3	2	1	0

Computer see

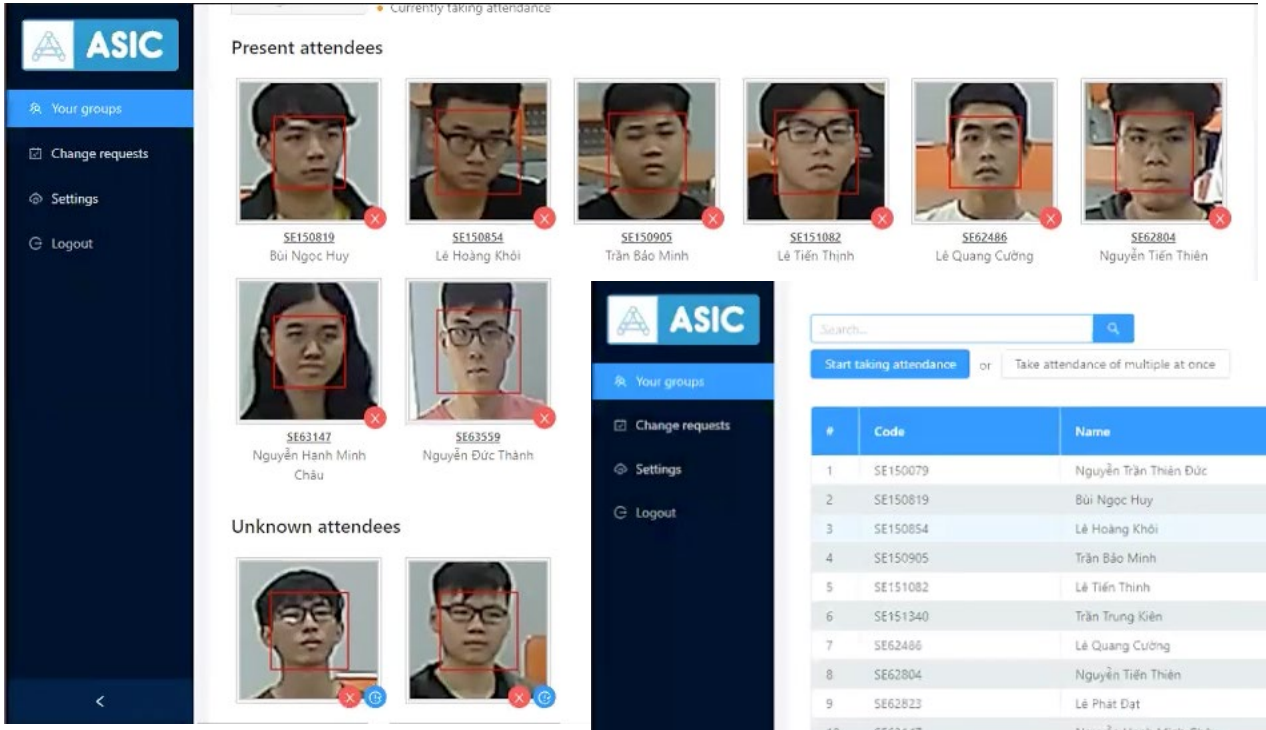
How Does Computer Vision Work?

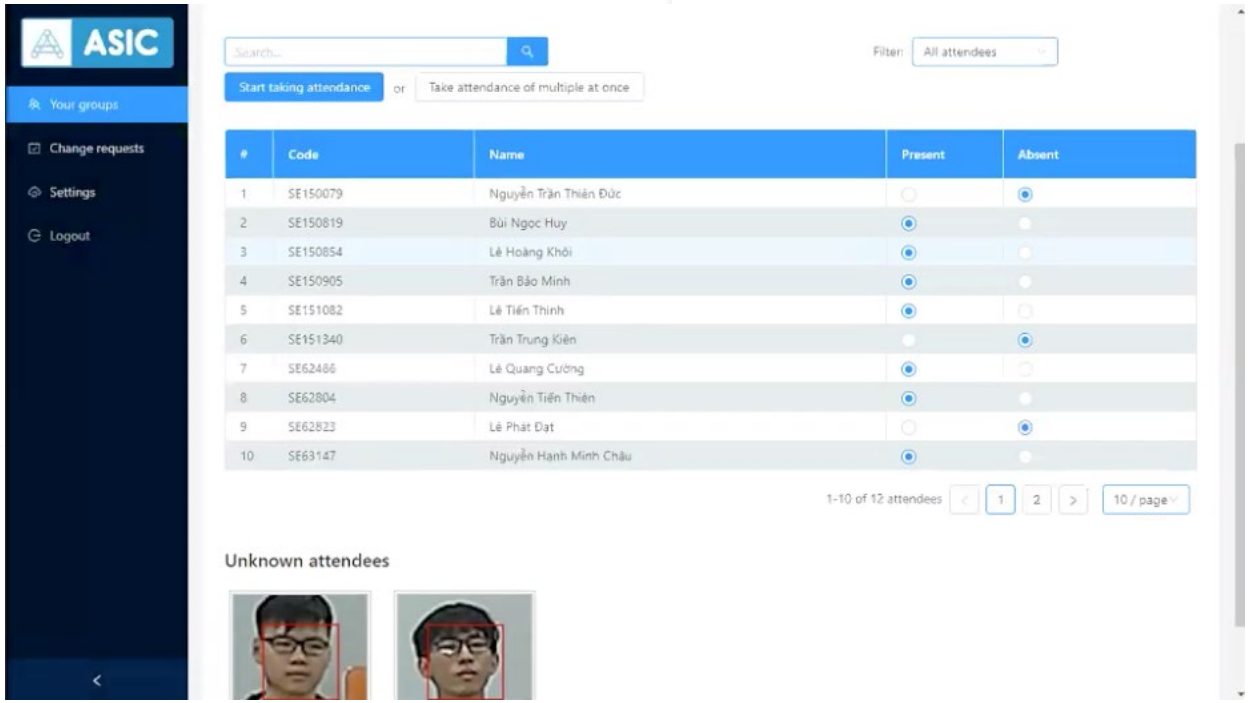
- Computer vision is a more high-level process of image processing- analysis of an image.
- The input is an image while the output is the interpretation of an image.
- Computer vision works by identifying different components in the image.

The computer vs human perception

- Computer likes human
  - Computers can be better at “easy” things
  - Humans are much better at “hard” things
- But huge progress has been made
  - Accelerating in the last 4 years due to deep learning
  - What is considered “hard” keeps changing

Application in Facial Recognition

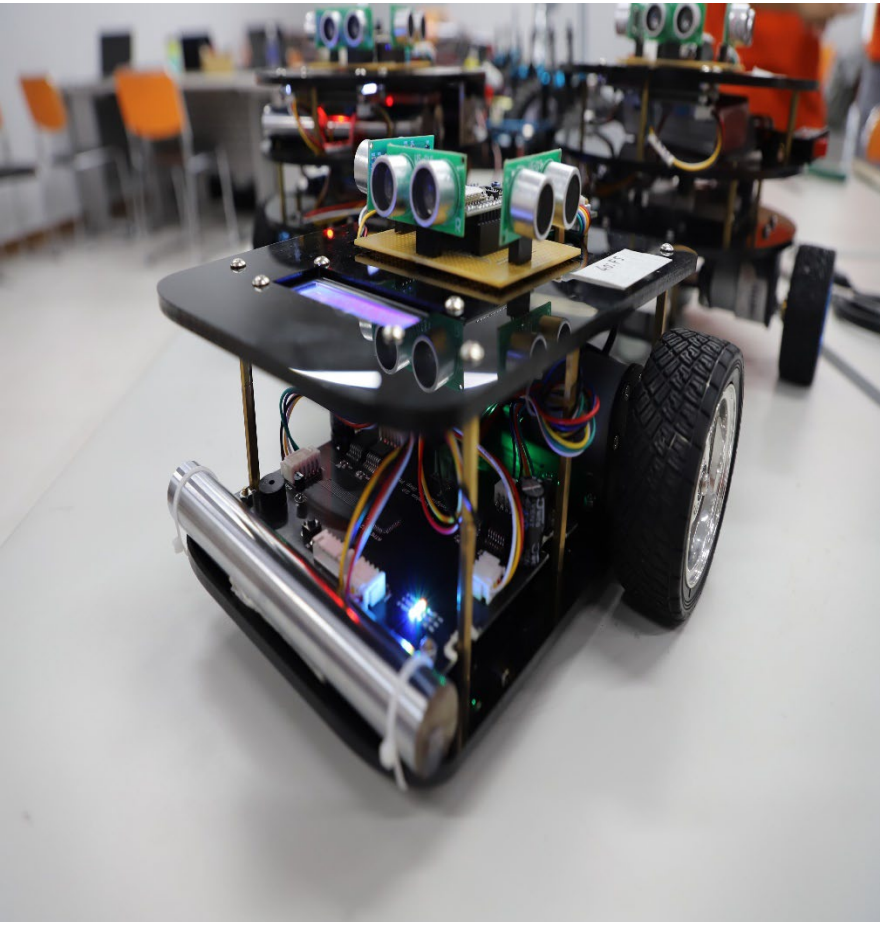




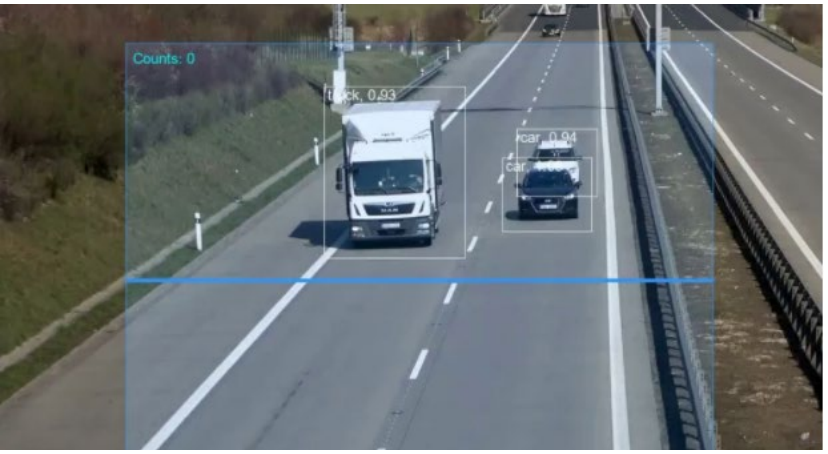
Application in life

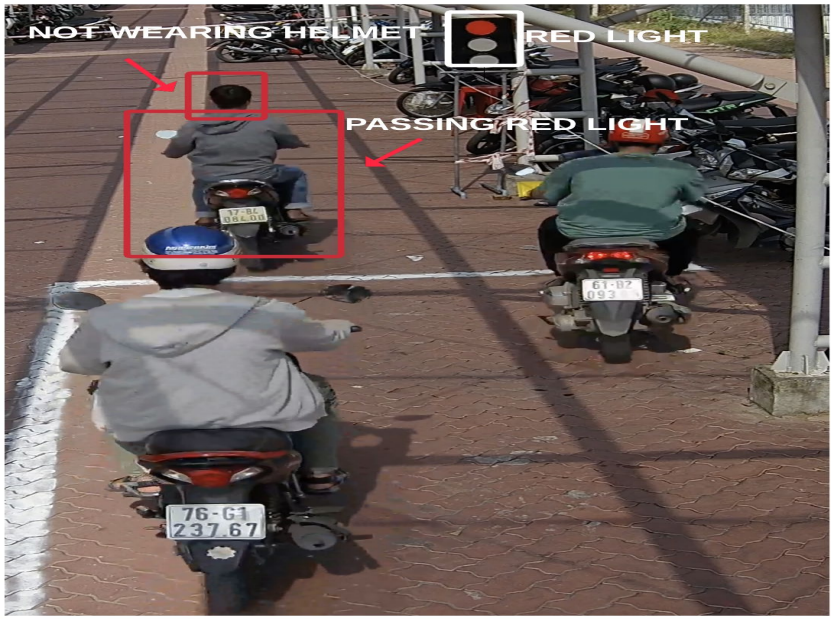
- Stroke Recognition
- Near Real-Time Coaching
- Sports Team Behaviors Analysis
- Automated Media Coverage
- Ball Tracking
- Goal-Line Technology
- Event Detection in Sports
- Sports Activity Scoring
- Player Pose Tracking

Application in Robotics



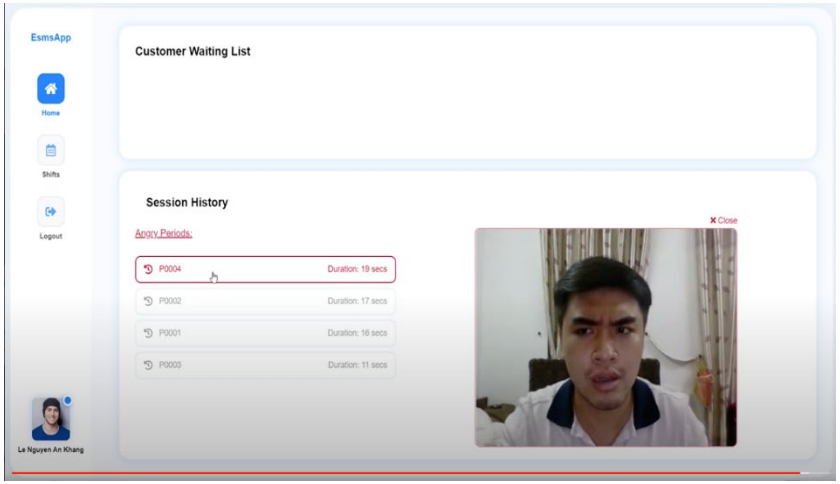
Application in Transportation





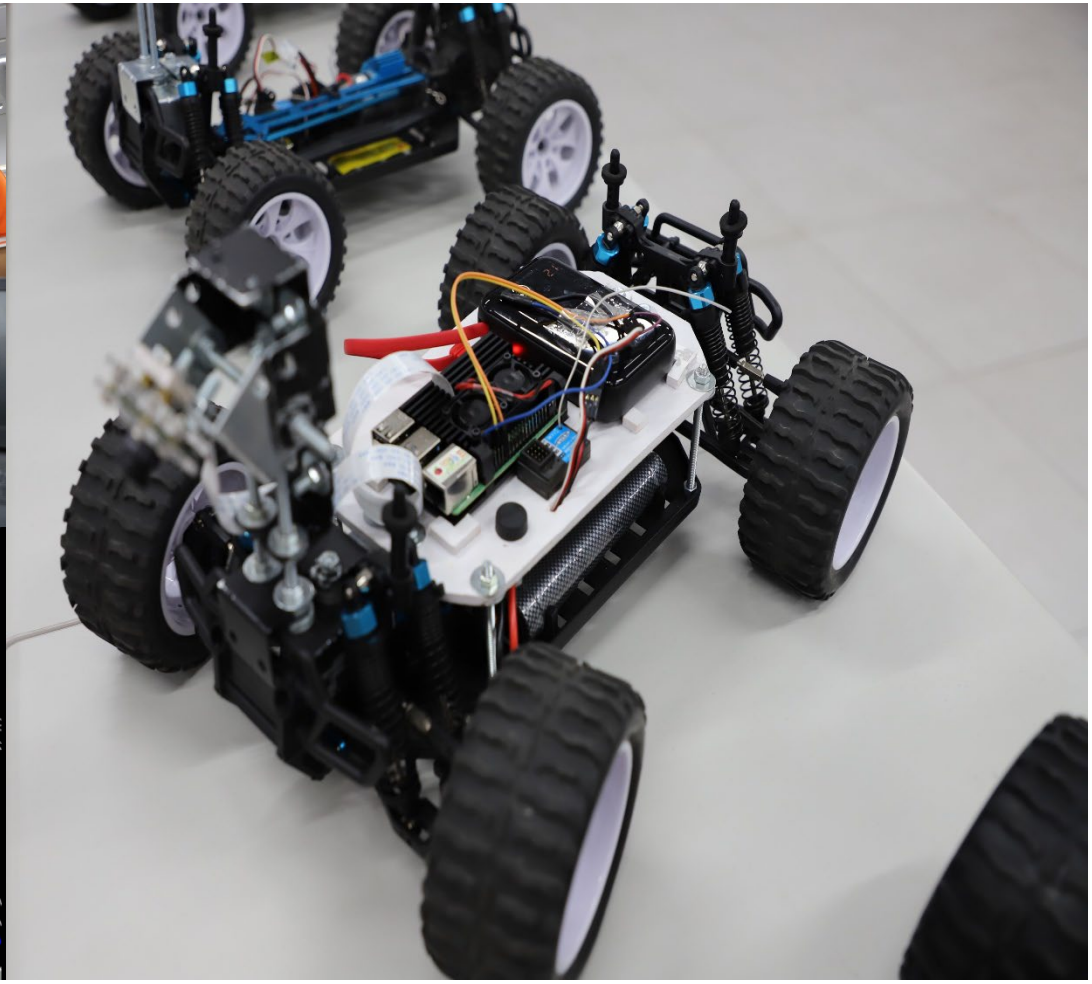
- Vehicle Classification
- Moving Violations Detection
- Traffic Flow Analysis
- Parking Occupancy Detection
- Automated License Plate Recognition
- Vehicle identification
- Traffic Sign Detection
- Road Condition Monitoring
- Driver Attentiveness Detection

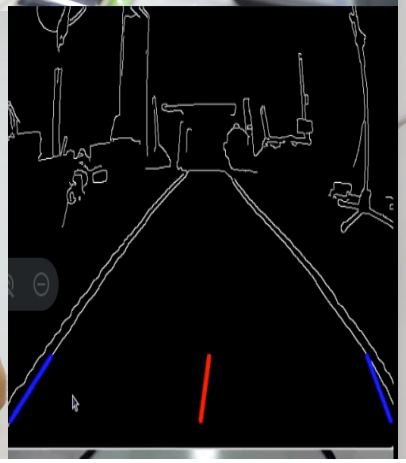
Application in Retail and Manufacturing



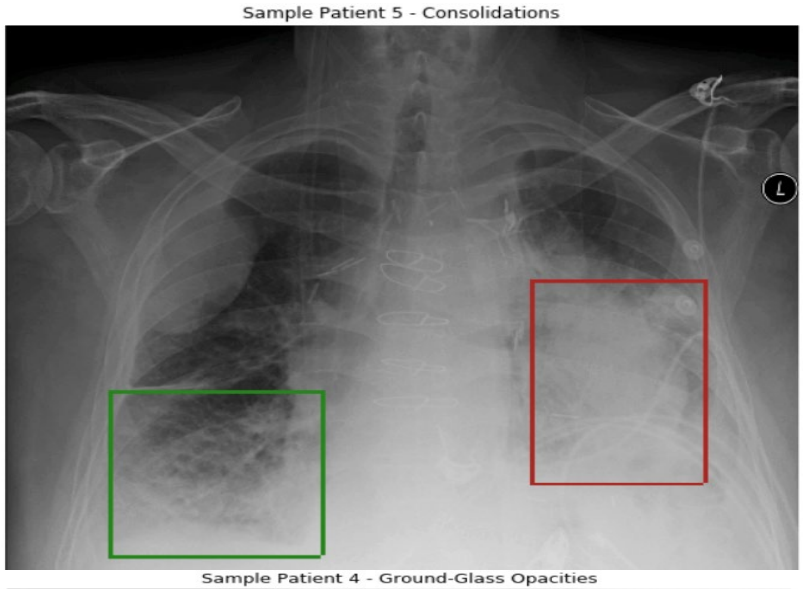
- Customer Tracking
- People Counting
- Theft Detection
- Waiting Time Analytics
- Social Distance
- Productivity Analytics
- Quality Management

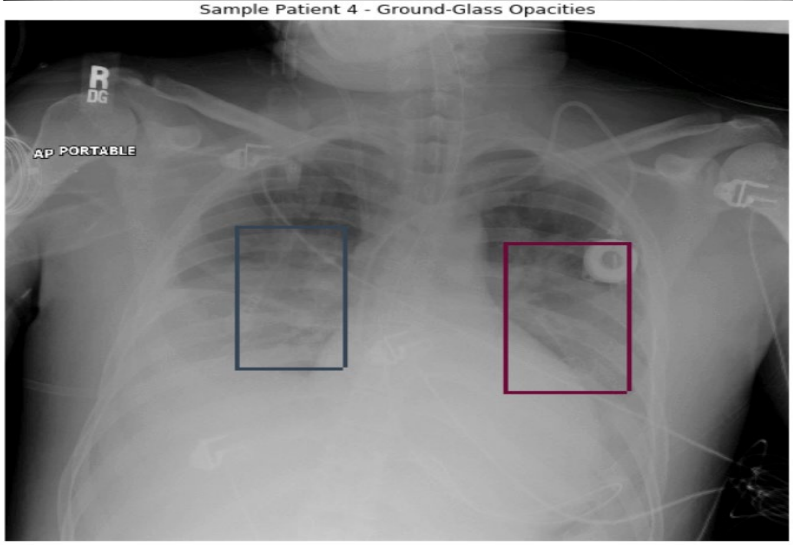
Application in Self-driving cars





Application in Medical





- Cancer Detection
- Cell Classification
- Movement Analysis
- Mask Detection
- Tumor Detection
- Disease Progression Score

Application in Agriculture

- Crop Monitoring
- Flowering Detection
- Plantation monitoring
- Insect Detection
- Plant Disease Detection
- Automatic weeding
- UAV Farmland Monitoring
- Animal Monitoring

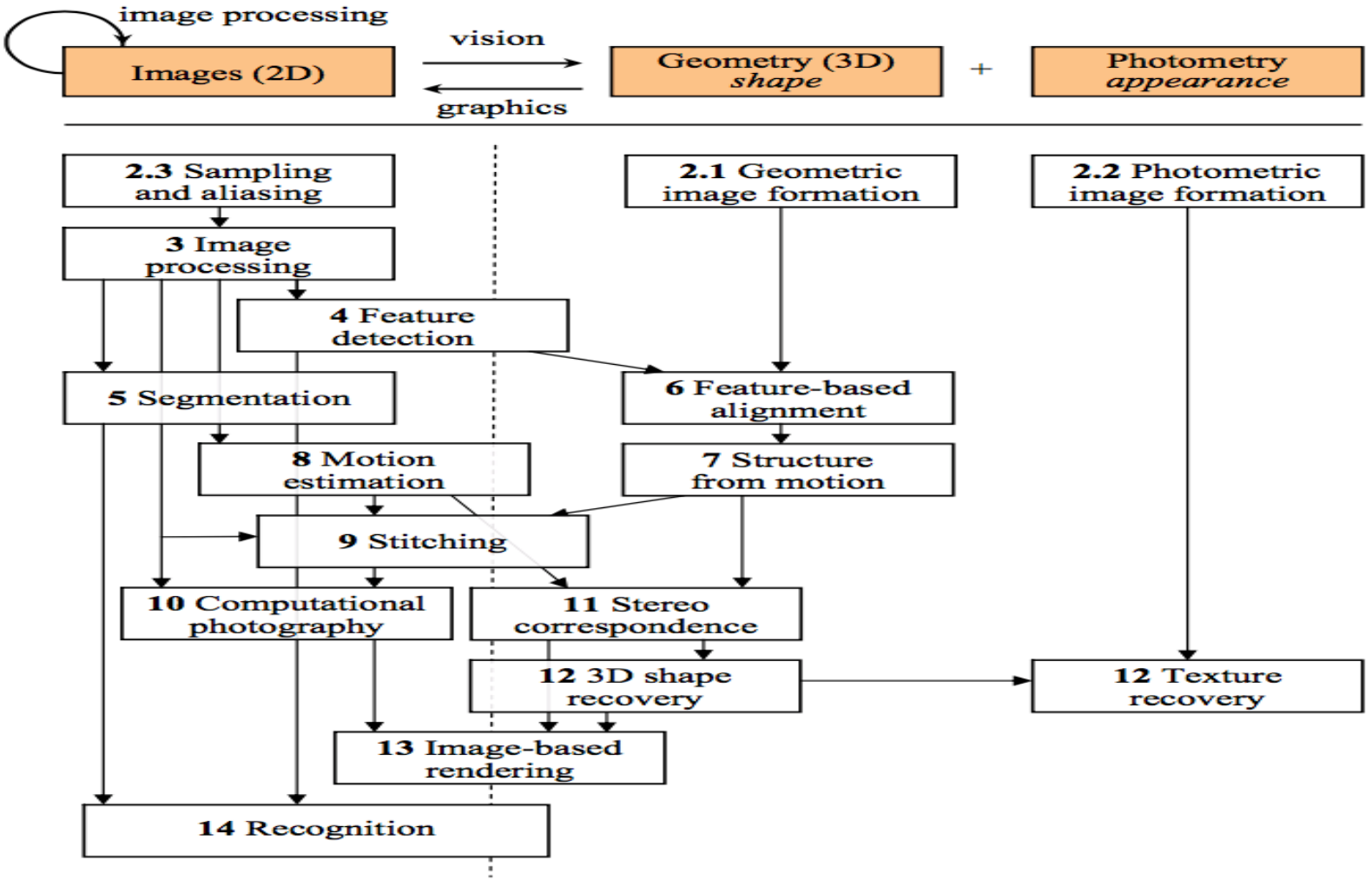
Challenges of Computer Vision

- Computer vision is a challenging field of computer science.
- Enabling a machine to be able to see, and process what it sees, like a human → difficult.
  - We are still learning exactly how human vision works
- Scene reconstruction- the creation of a 3D model
  - The inputting of 2D images or video, are also problematic.

Challenges of Computer Vision

- Recognition must become robust
  - Depend on object classification, identification, verification and detection
  - Depend on identify the key points or landmarks in a picture
  - Object segmentation, identifying the pixels in an image
- Once recognition is achieved CV systems must also correctly analyze the image.
- If applied to a video, this requires accurate motion analysis.
- This allows the system to estimate the velocity of objects in the video.

Relationship between images, geometry, and photometry



The future of computer vision

- Computer vision, as well as AI and machine learning concepts, are key to releasing complete, or Level 5, automation in self-driving vehicles.

Summary

- What is computer vision?
- Where are the computer vision apply for?
- What are the Challenges of Computer Vision?
- The future of computer vision?