Computer Vision for Pattern Recognition

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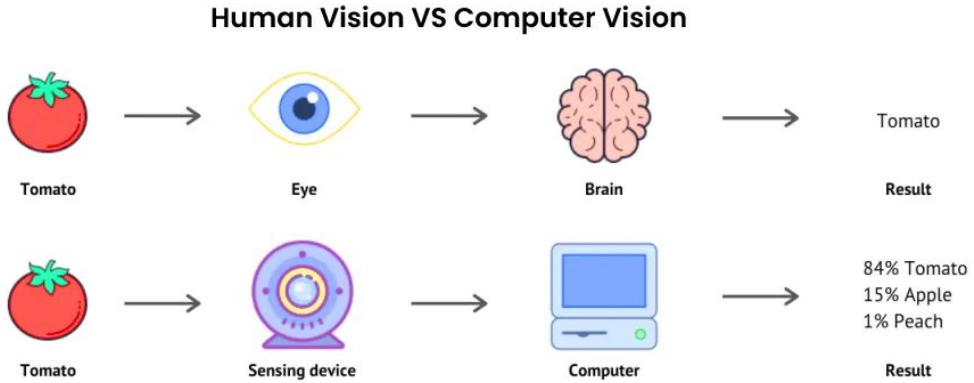
Recap

Computer vision is a field of artificial intelligence that trains computers to interpret and understand the visual world. By using digital images from cameras and videos and deep learning models, machines can accurately identify and classify objects and then react to what they "see."



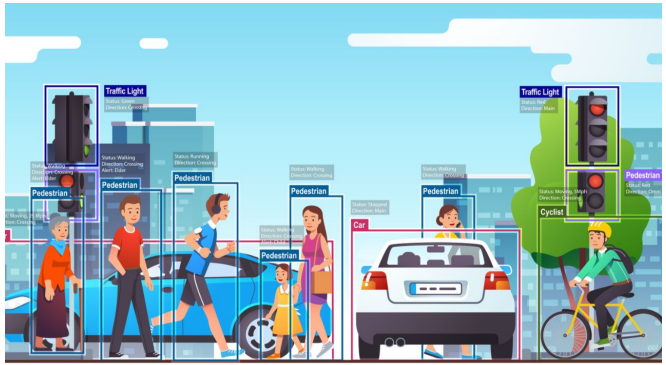
Why does Computer Vision Matter?

Pros:

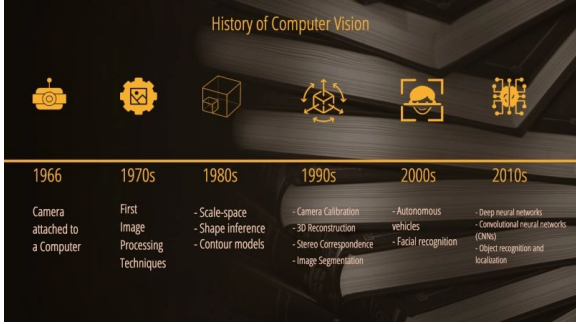
- Automation Efficiency
- Improved Insights
- Enhanced User Experience
- Safety and Security
- Innovation

Cons:

- Data Dependency
- Complexity
- Ethical and Privacy Concerns
- Interpretability and Trust
- Cost of Resources



Progression of Computer vision



1950s-1970s:

- Foundations of CV was mainly used for edge detection and object recognitions

1980s-1990s:

- Introduced feature-based methods for uses such as object tracking and image segmentation

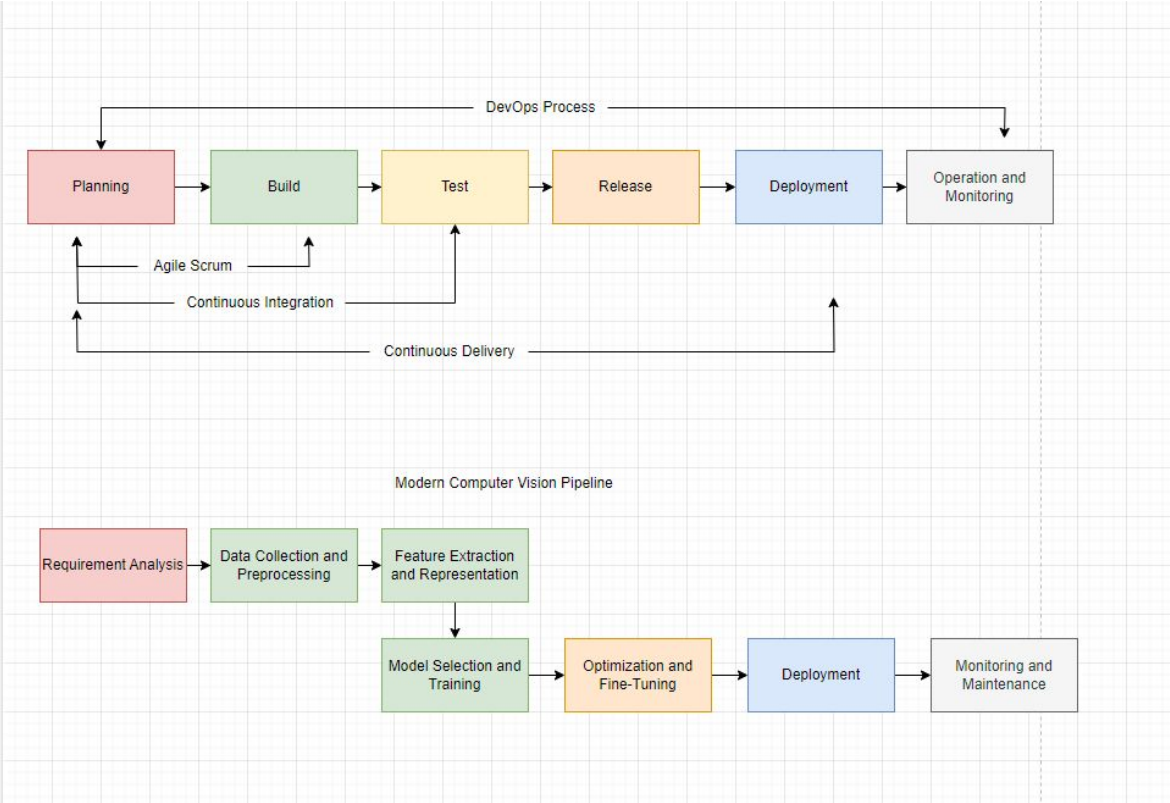
1990s-2000s:

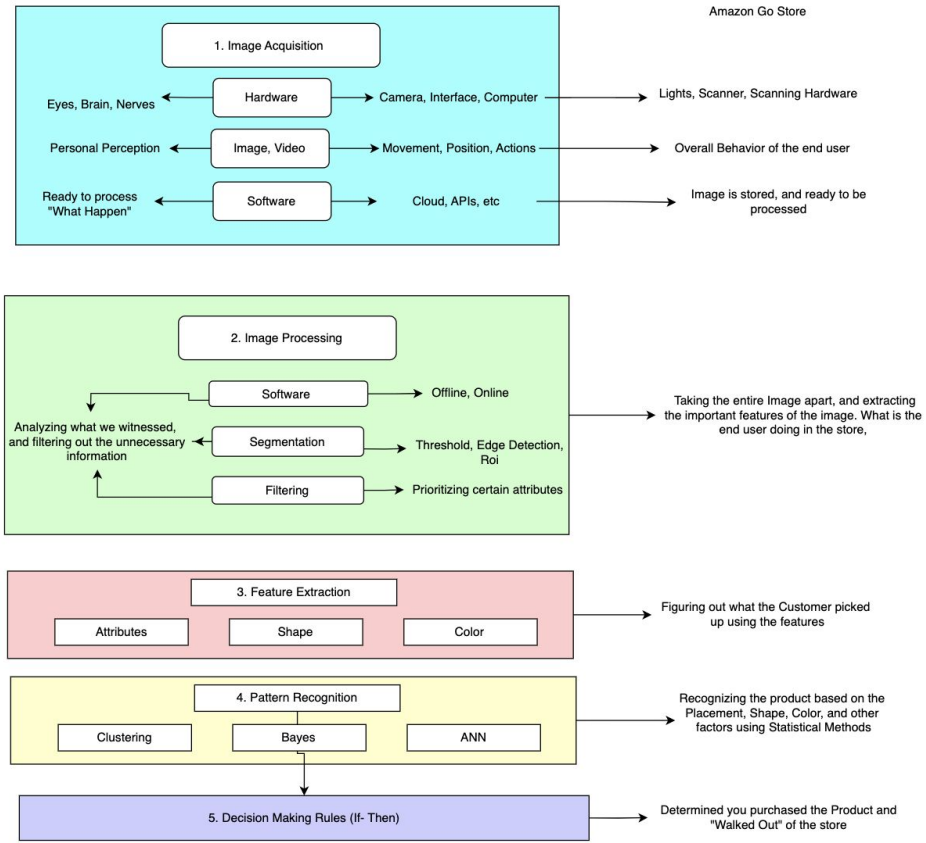
- Statistical Machine Learning with Machine Learning Techniques

2010s - Present Day:

- Deep Learning and Neural Networks Revolution

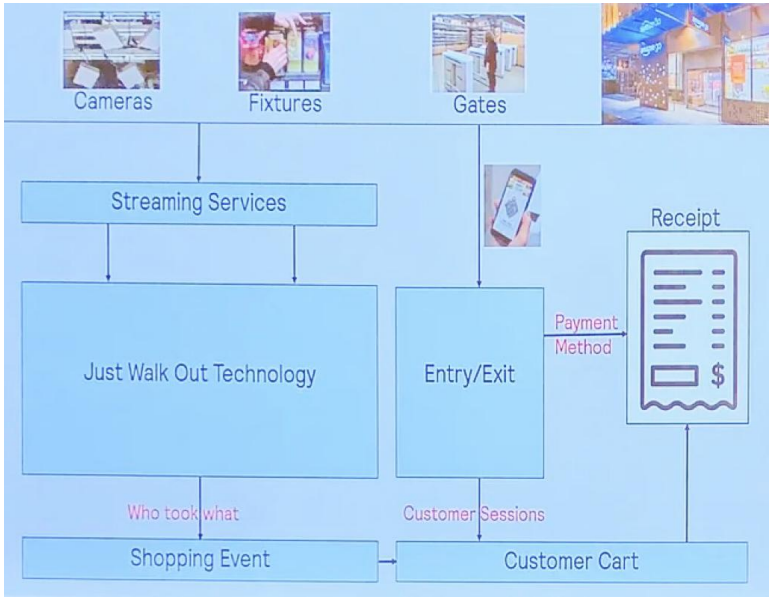
DevOps Approach & Modern CV Pipeline




Amazon Go Store
1. Image Acquisition
Eyes, Brain, Nerves
Hardware
Camera, Interface, Computer
Lights, Scanner, Scanning Hardware
Personal Perception
Image, Video
Movement, Position, Actions
Overall Behavior of the end user
Ready to process "What Happen"
Software
Cloud, APIs, etc
Image is stored, and ready to be processed
2. Image Processing
Software
Offline, Online
Analyzing what we witnessed, and filtering out the unnecessary information
Segmentation
Threshold, Edge Detection, Roi
Filtering
Prioritizing certain attributes
Taking the entire Image apart, and extracting the important features of the image. What is the end user doing in the store,
3. Feature Extraction
Attributes
Shape
Color
Figuring out what the Customer picked up using the features
4. Pattern Recognition
Clustering
Bayes
ANN
Recognizing the product based on the Placement, Shape, Color, and other factors using Statistical Methods
5. Decision Making Rules (If- Then)
Determined you purchased the Product and "Walked Out" of the store

Amazon Go & “Just Walk Out” Tech

- Revolutionizing the retail industry with Just Walk Out Technology
- High-level architecture of the platform



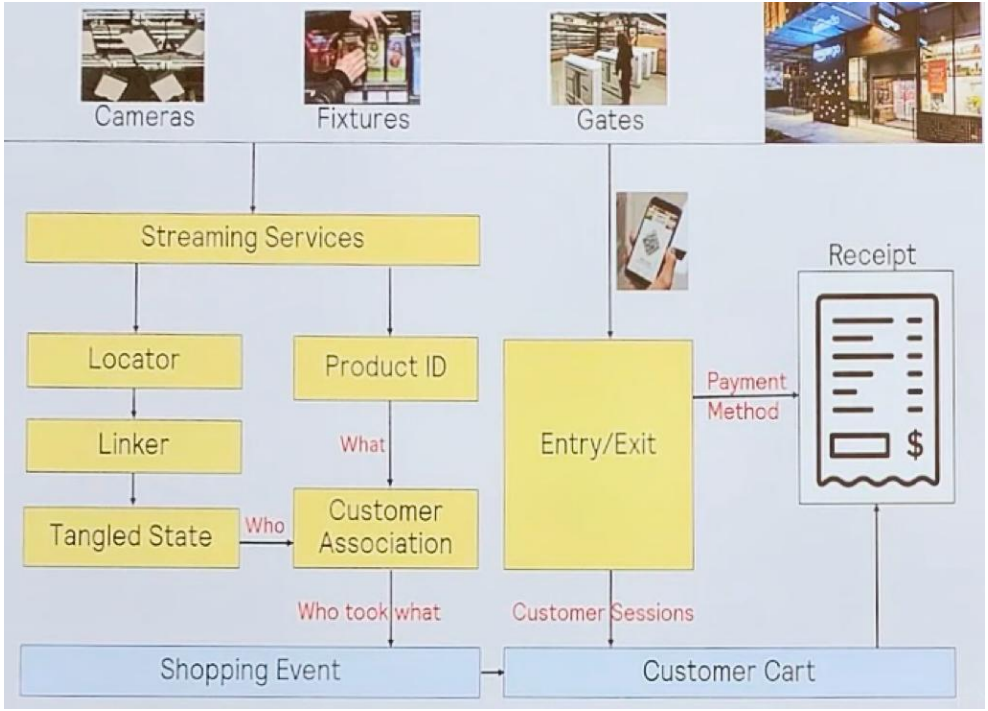
Requirements for Just Walk Out System

- Calibration
  - Have each camera know its location in the store very accurately
  - Camera Calibration, 3D Store Mapping, Continuous Monitoring
- Sensor fusion
  - Aggregate signals across different sensors or cameras
  - Sensor Fusion, Data Triangulation, Multi-view Tracking
- Activity analysis (Picking Up vs. Putting Down)
  - Determine whether a person has picked up vs. returned an item
  - Object Detection & Tracking, Action Recognition, Contextual Understanding

High-level system architecture of the platform:“Just Walk Out” Architecture

- **Person Detection:** Through continuous identification and tracking, the system can monitor the presence and movements of individuals within the store in real-time.
- **Object Recognition:** The technology is capable of distinguishing between different items available for purchase, allowing for accurate tracking of inventory and purchases.
- **Pose Estimation:** By analyzing the posture and movements of customers near product shelves, the system can infer their intentions and actions, such as reaching for or returning items.

Detailed Just Walk Out Architecture



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- **How the Amazon Go Store's AI Works**
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