Introduction to Computer Vision

Course Leader

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Introduction to Computer Vision

- At the end of these lectures, students will be able to:
  - Understand what is Computer Vision and its history.
  - Indentify the challenges and application of Computer Vision.
  - Understand the current Computer Vision market trend .
  - Describe the steps involved in Computer Vision.

What is Computer Vision?

Emulating human vision through machines.

Computer Vision

- The ability of computer to see and understand the visual data
  - Image Understanding
  - Machine Vision
  - Robot Vision
  - Image Analysis
  - Video understanding

One image is worth thousand words

History of Computer vision

The **first digital** photo actually came almost two decades earlier in 1957 when Russell Kirsch made a 176×176 pixel **digital image** by scanning a photograph of his three-month-old son.

History of Computer vision

The father of Computer Vision is Larry Roberts, who in his Ph.D. thesis (cir. 1960) at MIT* discussed the possibilities of extracting 3D geometrical information from 2D perspective views of blocks (polyhedral).

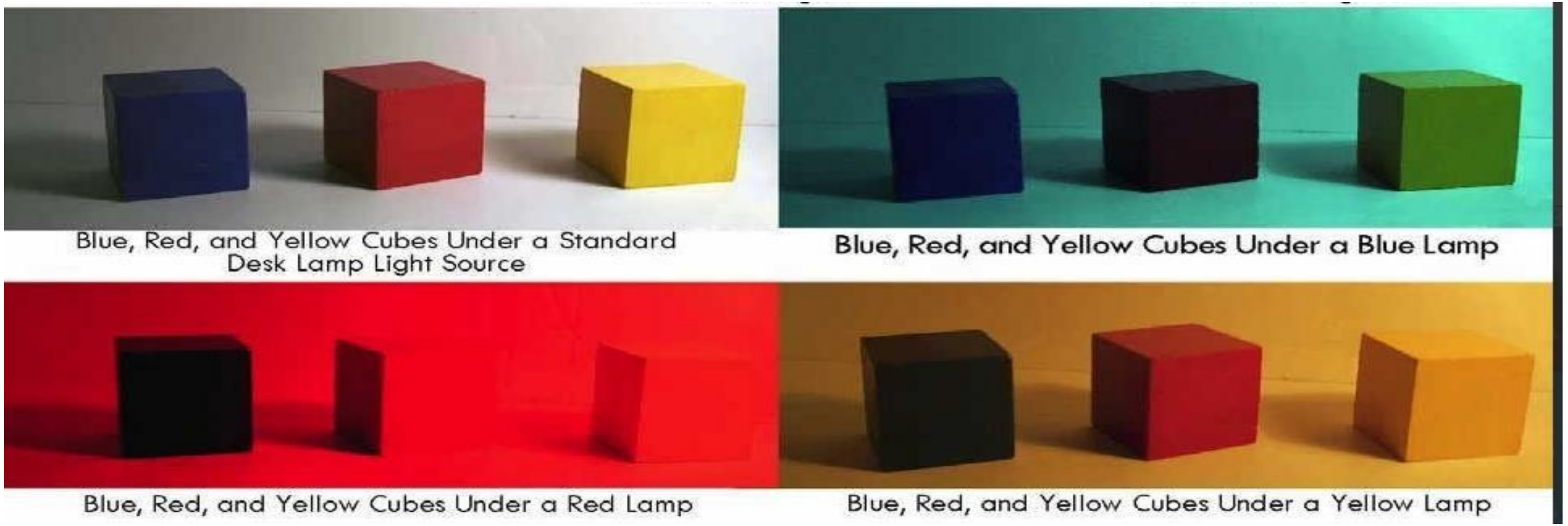
*Massachusetts Institute of Technology, USA

Challenges in Computer Vision

Vision is an amazing feat of natural intelligence

- Visual cortex occupies about 50% of brain
- More human brain devoted to vision than anything else
- Predicting 3 D structures using 2 D images.
- Objects looks different in different lights.
- Recognizing the same object with different background.

Objects looks different in different lights



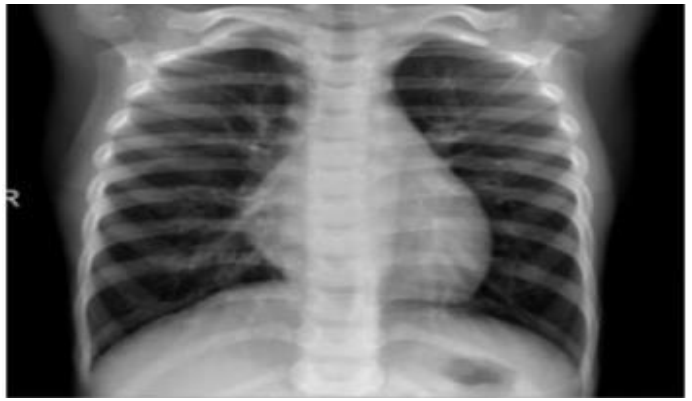
Applications of Computer vision

A few applications of computer vision include.

- Automatic inspection, *e.g.*, in manufacturing applications;
- Assisting humans in identification tasks, e.g., a species identification system.
- Detecting events, *e.g.*, for visual surveillance or people counting, e.g., in the restaurant industry;
- Modeling objects or environments, *e.g.*, medical image analysis
- Navigation, *e.g.*, by an autonomous vehicle or mobile robot; and

Applications of Computer Vision

Safety: Driver assisting modules to avoid accidents



Health: Predicting COVID 19

Optical character recognition (OCR)

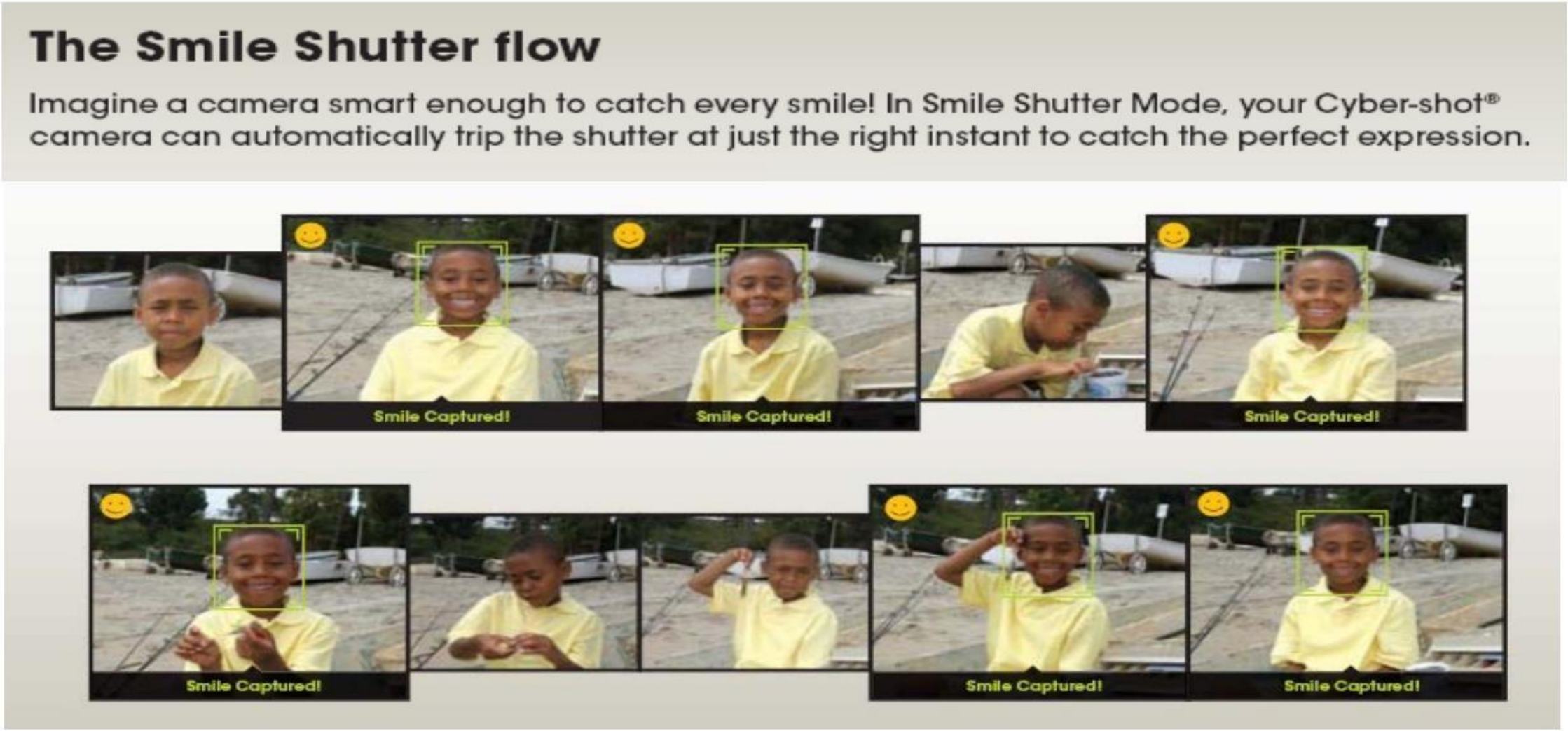
- Technology to convert scanned docs to text

License plate readers

Face detection

Many new digital cameras now detect faces – Canon, Sony, Fuji,

Smile detection



Object recognition (in supermarkets)

- "A smart camera is flush-mounted in the checkout lane, continuously watching for items. When an item is detected and recognized, the cashier verifies the quantity of items that were found under the basket, and continues to close the transaction. The item can remain under the basket, and with LaneHawk,you are assured to get paid for it…

Login without a password…

Fingerprint scanners on many new laptops, other devices

Face recognition systems now beginning to appear more widely

Object recognition (in mobile phones)

Point and Find – Nokia Google Goggles

Augmented Reality

Overlays digital images onto your view of the real world, often through a smartphone.

Virtual Reality

Primarily uses a headset to create an immersive 3D experience.

Top Ten computer vision Companies

rank	*ticker*	*Company Name*	*Market Cap (Billions)**
1	GOOGL	Alphabet Inc.	760.31
2	FB	Facebook, Inc.	447.29
3	INTC	Intel Corporation	207.36
4	HRS	Harris Geospatial Solutions	20.06
5	TDY	Teledyne Technologies Incorporated	8.1
6	CGNX	Cognex Corporation	7.61
7	NATI	National Instruments Corporation	5.79
8	NOVT	Novanta Inc.	2.3
9	AMBA	Ambarella, Inc.	1.09
10	CEVA	CEVA, Inc.	0.5769

KritiKal Solutions - OCR Solutions

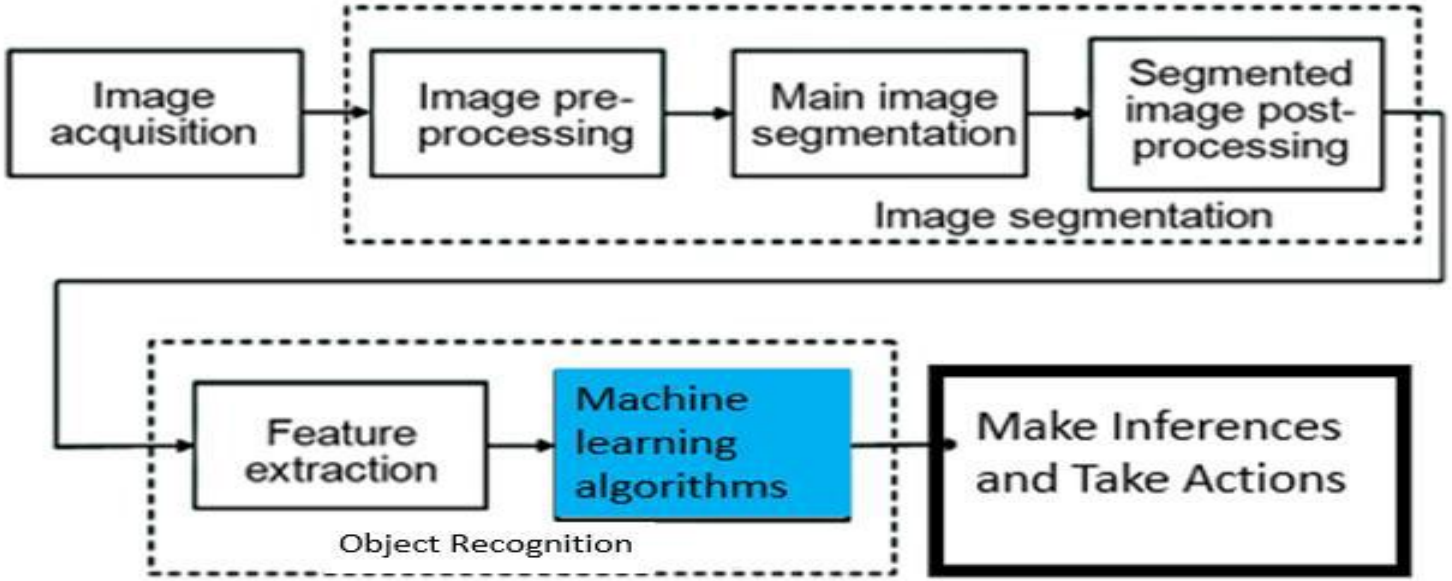
FaceX - Facial Recognition Software

Some more computer vision companies

- GE
- SIEMENS
- PHILIPS
- IBM WATSON
- GOOGLE & DEEPMIND
- BAIDU
- FACEBOOK
- MICROSOFT
- AMAZON
- APPLE
- NVIDIA

Frame work for Computer Vision

- **Computer vision is a field of artificial intelligence that trains computers to interpret and understand the visual world. 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."**



Summary

- What is computer vision
- History of computer vision
- Applications of computer vision
- Top ten companies of computer vision.
- Frame work for Computer Vision