

# Computer Vision for Visual Perception

## Introduction to Computer Vision

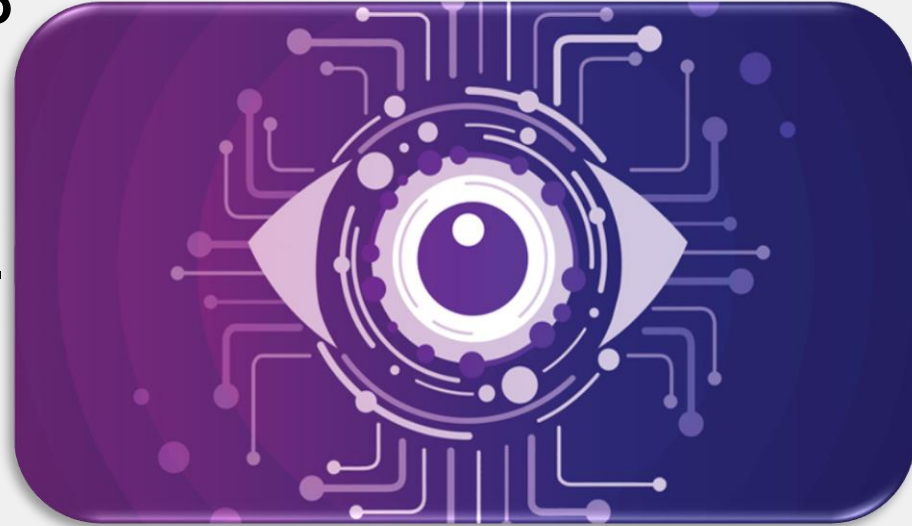
# Learning Objectives

- **Need of Computer Vision**
- **Computer Vision**
  - Definition
  - Usage
  - How it Works?
  - Technical Equipment Needed
  - Applications
- **Human Vision v/s Computer Vision**
- **Computer Vision for Road Scene**
- **Computer Vision in SDC**
- **Summary**
- **References**

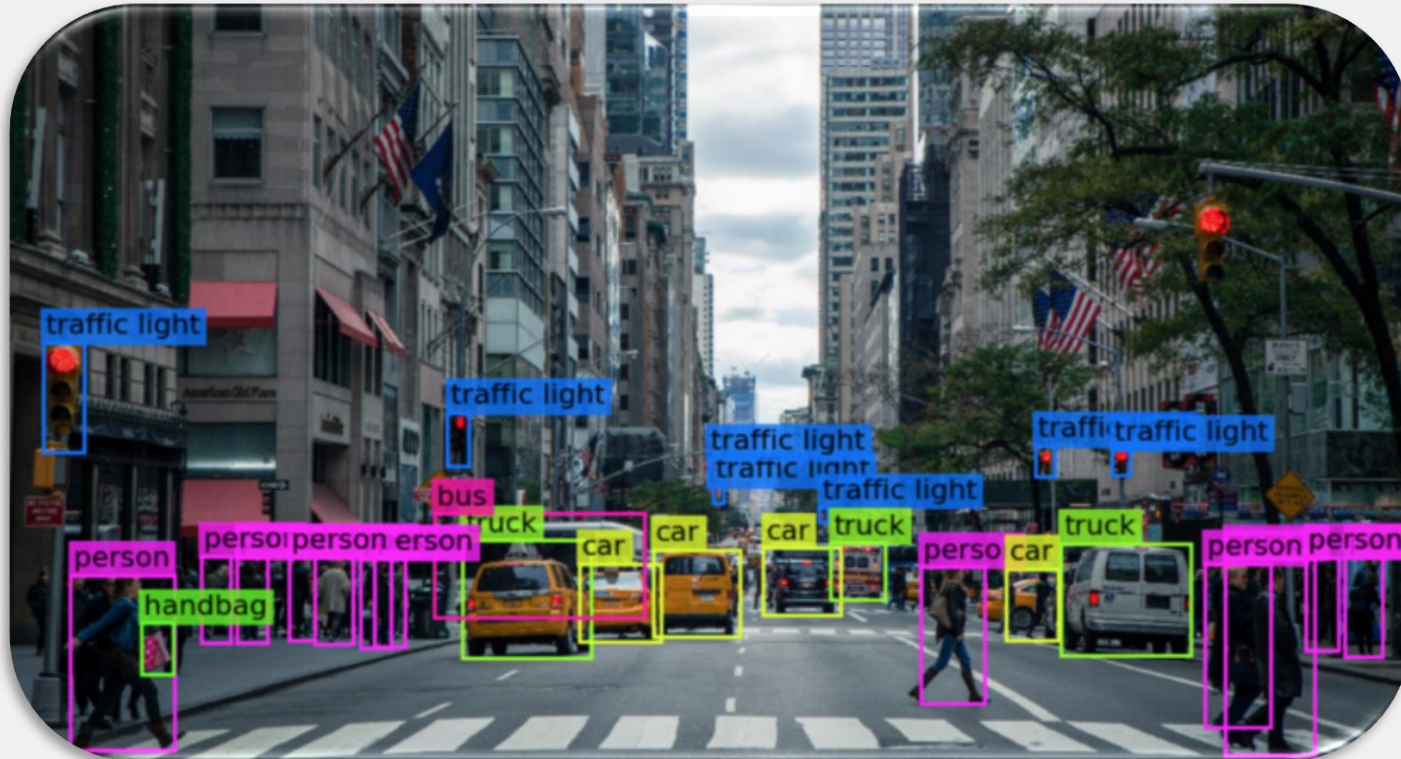


# Need of Computer Vision

- Interaction of physical world to digital world?
- Understanding of physical activities, images, actions, etc. digitally?
- Possible solution is Computer Vision.



# Need of Computer Vision



Computer Vision technology enables computers to detect people & objects in images.

# Computer Vision – Definition

- The field of computer science.
- Focuses on replicating parts of the complexity of the human vision system.
- Enables computers to identify and process objects in images and videos.
- Works in same way as humans do.

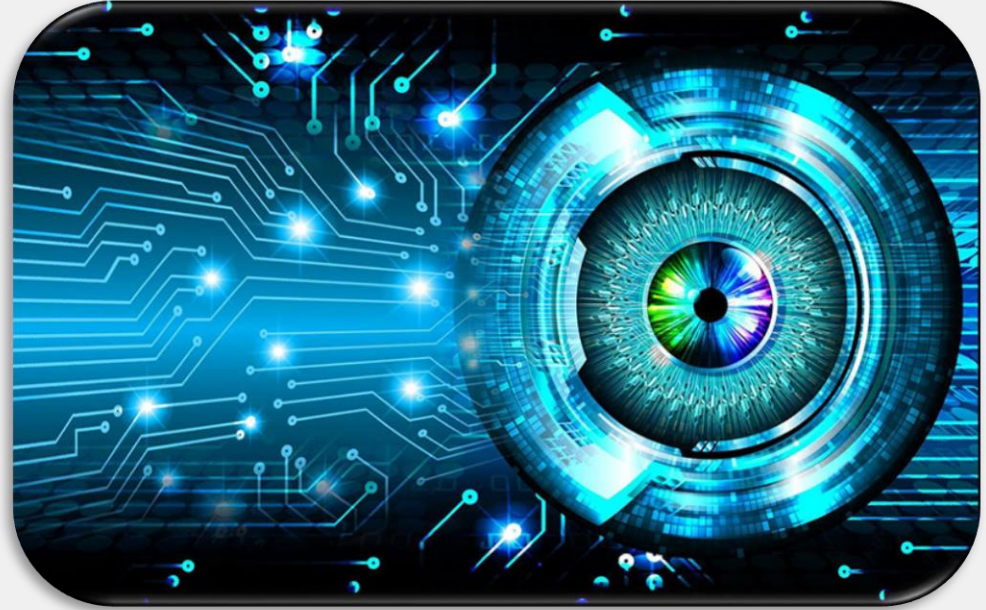




# Computer Vision – Usage

- **Computer Vision systems used for:**

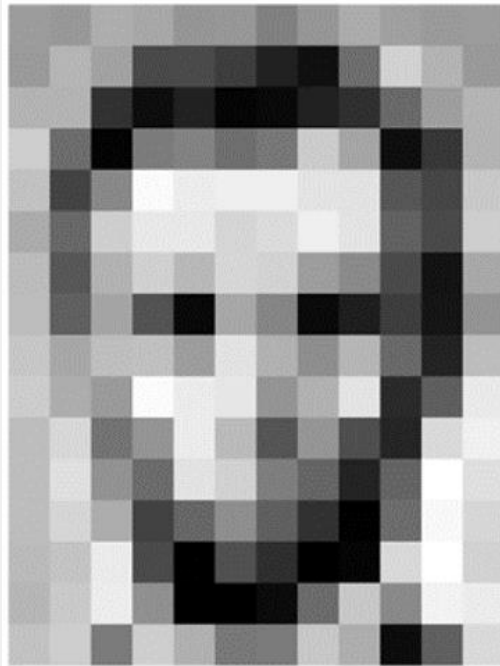
- **Object Classification**
- **Object Identification**
- **Object Tracking**



# Computer Vision – How it works?



AUGMENTED STARTUPS  
Computer Vision | AI | Robotics



157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	5	124	131	111	120	204	166	15	56	180
194	68	137	251	237	239	239	228	227	87	71	201
172	106	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	158	139	75	20	169
189	97	165	84	10	168	134	11	31	62	22	148
199	168	191	193	158	227	178	143	182	106	36	190
205	174	155	252	236	231	149	178	228	43	95	234
190	216	116	149	236	187	86	150	79	38	218	241
190	224	147	108	227	210	127	102	36	101	255	224
190	214	173	66	103	143	96	50	2	109	249	215
187	196	235	75	1	81	47	0	6	217	255	211
183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218

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Color values of individual pixels are converted into a simple array of numbers used as input for a computer vision algorithm.

# Computer Vision – Technical Equipment Needed

- Two key technologies are needed:
  - Convolutional Neural Network
  - Deep Learning
- Both are types of ML.





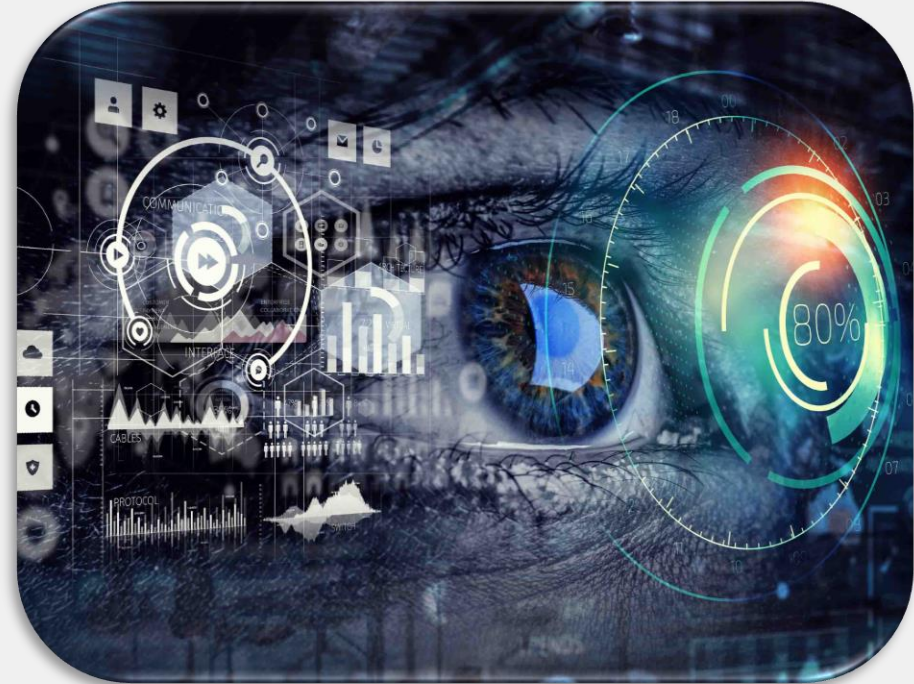
# Computer Vision – Applications

- **Google Translator**
  - Translates over 100 languages.
  - Also available for offline use.
  - No network connection required.



# Computer Vision – Applications

- **Facebook 3D Photo**
  - **Conversion of 2D images into 3D.**
  - **Work by tilting, rotating, or scrolling the smartphones.**
  - **ML is used behind this algorithm.**



# Computer Vision – Applications

- **YOLO**
  - **Stands for You Only Look Once (YOLO).**
  - **Detect & recognize objects in a visual input in real-time.**
  - **Track people within specific geographical area.**



- **FaceApp**
  - **Image manipulation application**
  - **Modifies human faces to change gender, age, & other features.**
  - **Work on computer vision to recognize patterns.**

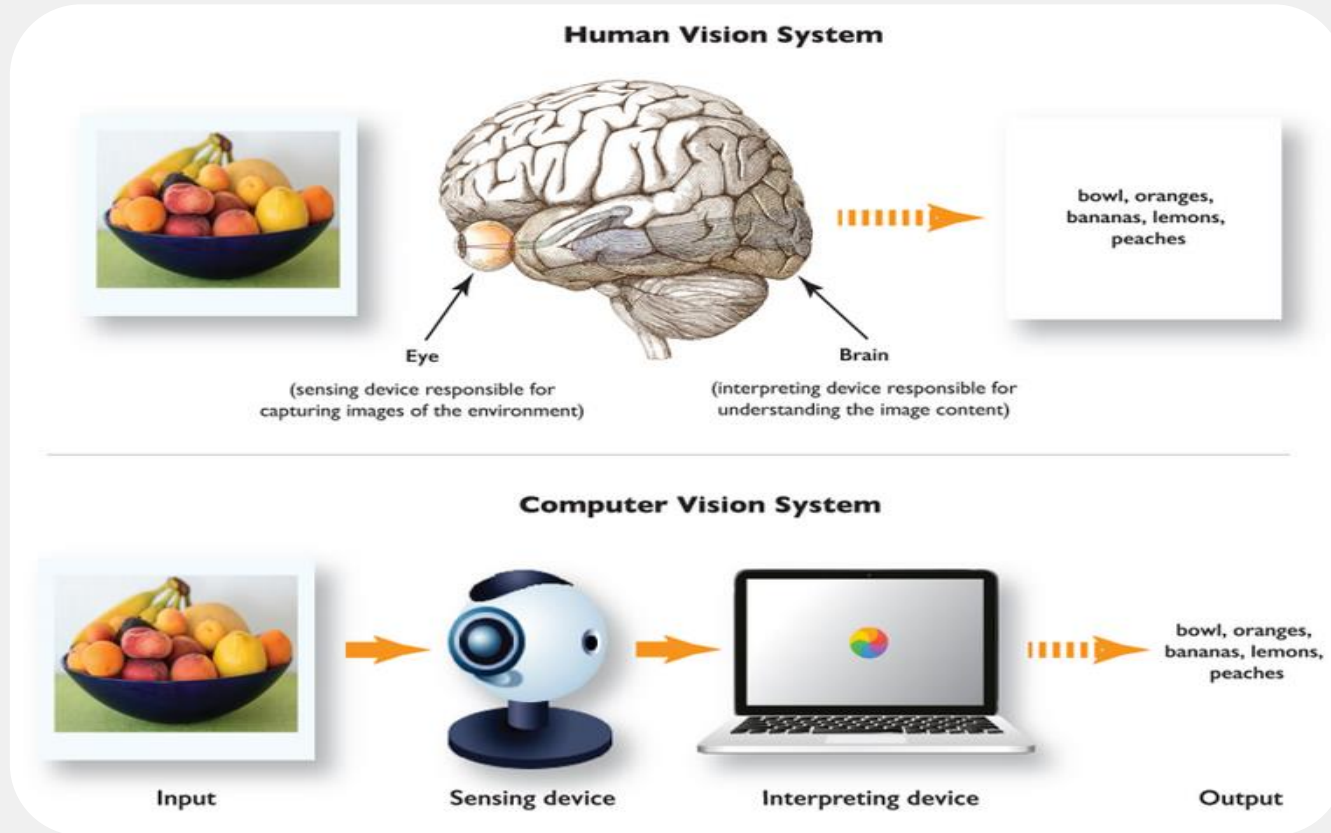


# Computer Vision – Top Applications

- **Agriculture**
- **Autonomous Vehicle**
- **Facial Recognition**
- **Human Pose Tracking**
- **Interactive Entertainment**
- **Medical Imaging**
- **Manufacturing**
- **Retail Management**
- **Education**
- **Transportation**



# Human Vision v/s Computer Vision



Human vision & computer vision systems process visual data in a similar way.

# Scene Understanding

- **Scene Understanding is to understand a scene.**
- • **For example: iPhone has function that help eye disabled person to take a photo by describing what the camera sees.**



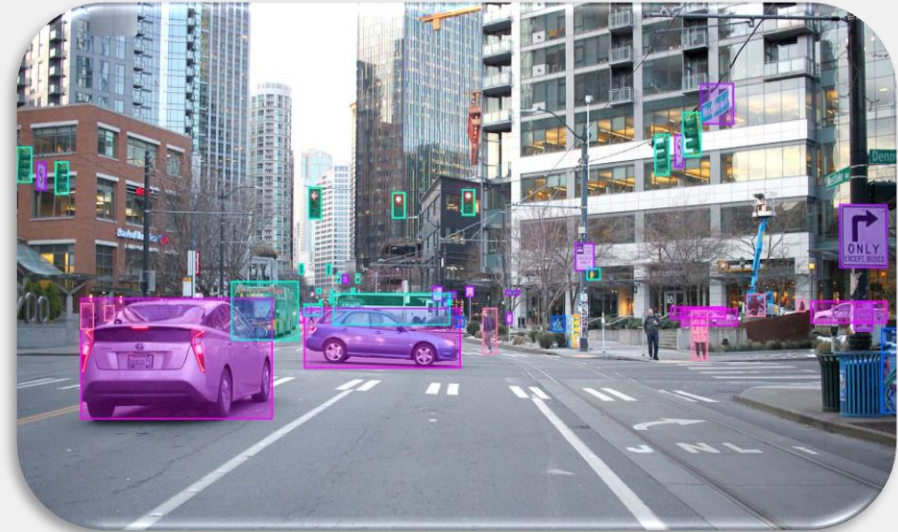
# Computer Vision for Road Scene Understanding

- Analyzing the road scenes using sensors such as camera could have a crucial impact in many domains.
- For instance: Autonomous driving, advanced driver assistance system (ADAS), personal navigation, mapping of large scale environments, & road maintenance.



# Computer Vision for SDC

- **Computer Vision helps to make the autonomous vehicle more intelligent using multiple sensors.**
- **Tesla's autonomous cars use multi-camera setup to analyze their surroundings and environment.**





# Summary

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# References

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Thanks