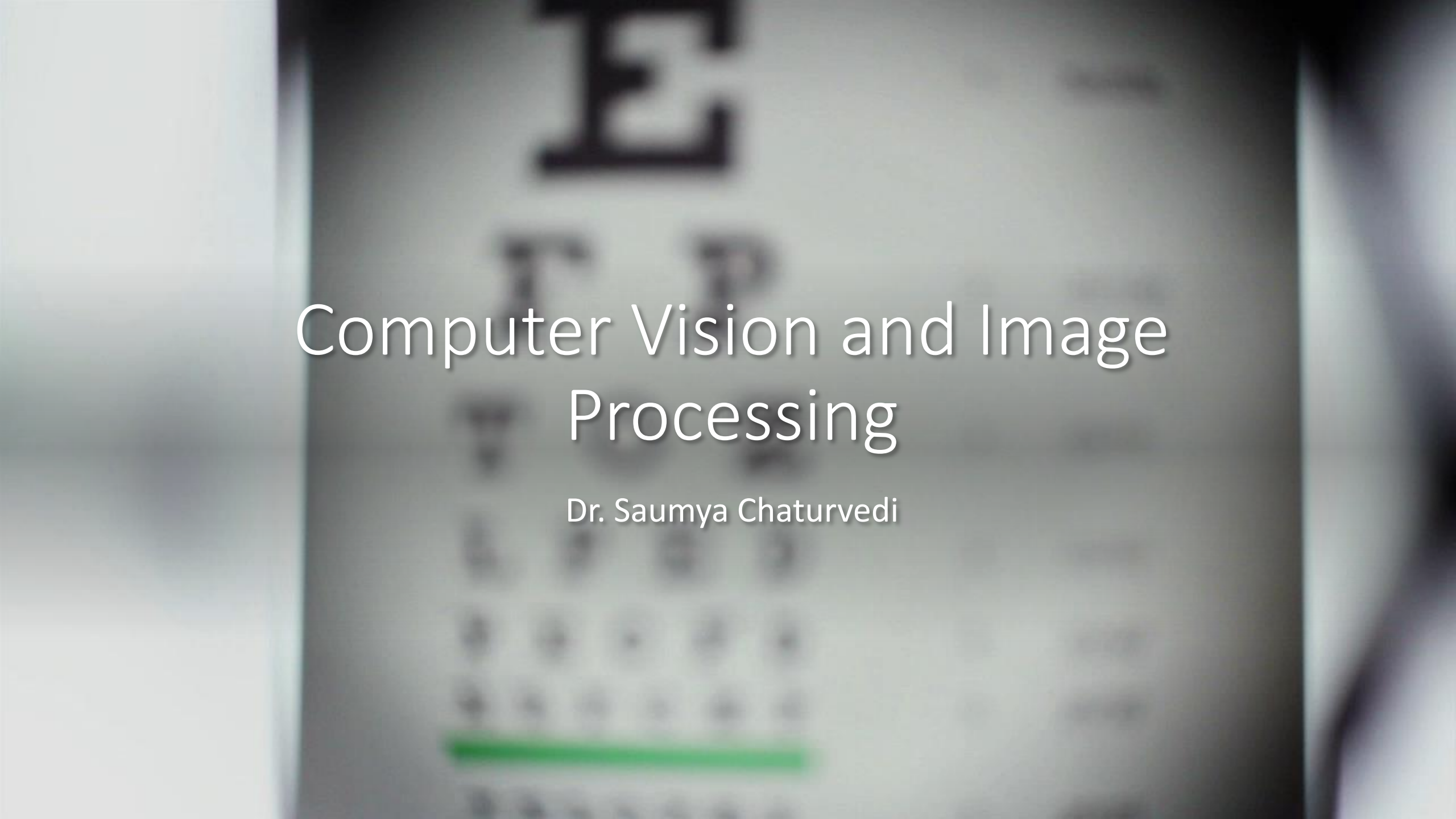


Computer Vision and Image Processing

Dr. Saumya Chaturvedi

- Many problems that were considered impossible to be solved by a computer once can now be solved because of a very specific kind of Artificial Intelligence called computer vision.
- It has given our systems the ability to not just see an image but also understand its content.
- Computer vision is a field that has enabled machines not just to be able to look at an image but also to view it and figure out what that image contains with a remarkable level of accuracy.

Topics for discussion

- Why Computer Vision?
- What is Computer Vision?
- Evolution of Computer Vision
- Computer Vision and Image Processing
- Why is Computer Vision so challenging?
- Applications of Computer Vision

Why Computer Vision?

Figuring out the text contained in an image or being able to recognize a number in an image

Machines to be able to understand what a particular object looked like and what it should be called.

What is Computer Vision?

- Analyze and gain knowledge from visual data sources, such as an image or a video
- Enables them to learn from already existing data sources
- Computer vision makes heavy use of Machine Learning algorithms to learn about how to identify and label objects in images and videos
- Computer vision relies heavily on neural networks, CNNs (convolutional neural networks), RNNs (recurrent neural networks)
- CNNs are good at processing and understanding images
- RNNs are good at processing and understanding videos as they can process images with temporal (time-related) data.

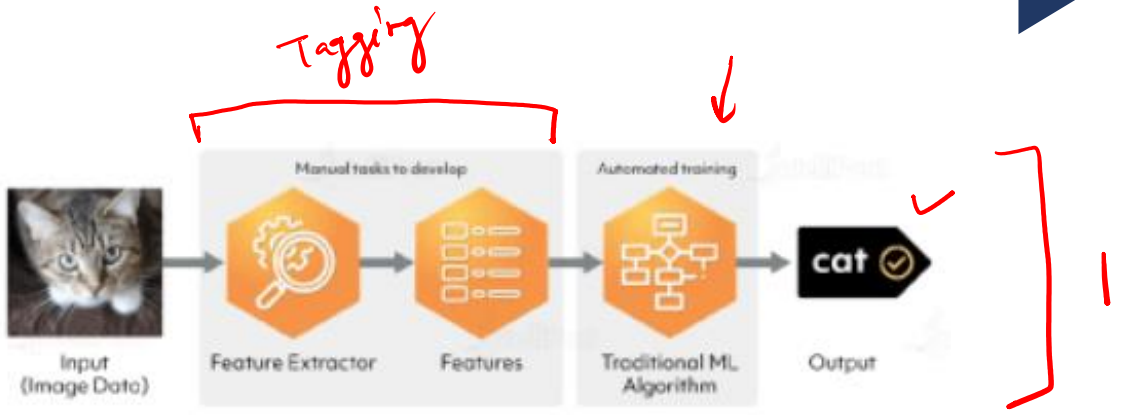
Evolution of Computer Vision

- There are several computer vision components involved in making computer vision what it is today. Deep Learning is a big factor that has made computer vision so useful. But, even before Deep Learning came into being, computer vision was in use. However, it was not very powerful and required manually coding a lot of rules so that an application can derive some insights out of images.
- This technique involved a few steps:

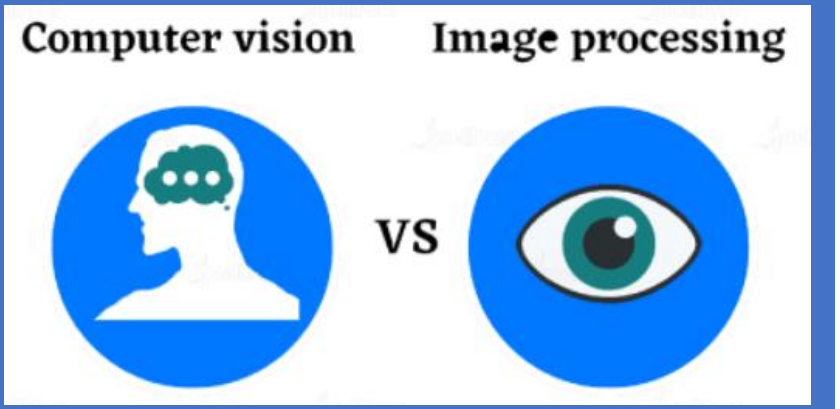
➢ Creating a Database

➢ Annotating Images

➢ Adding New Images



Computer Vision and Image Processing



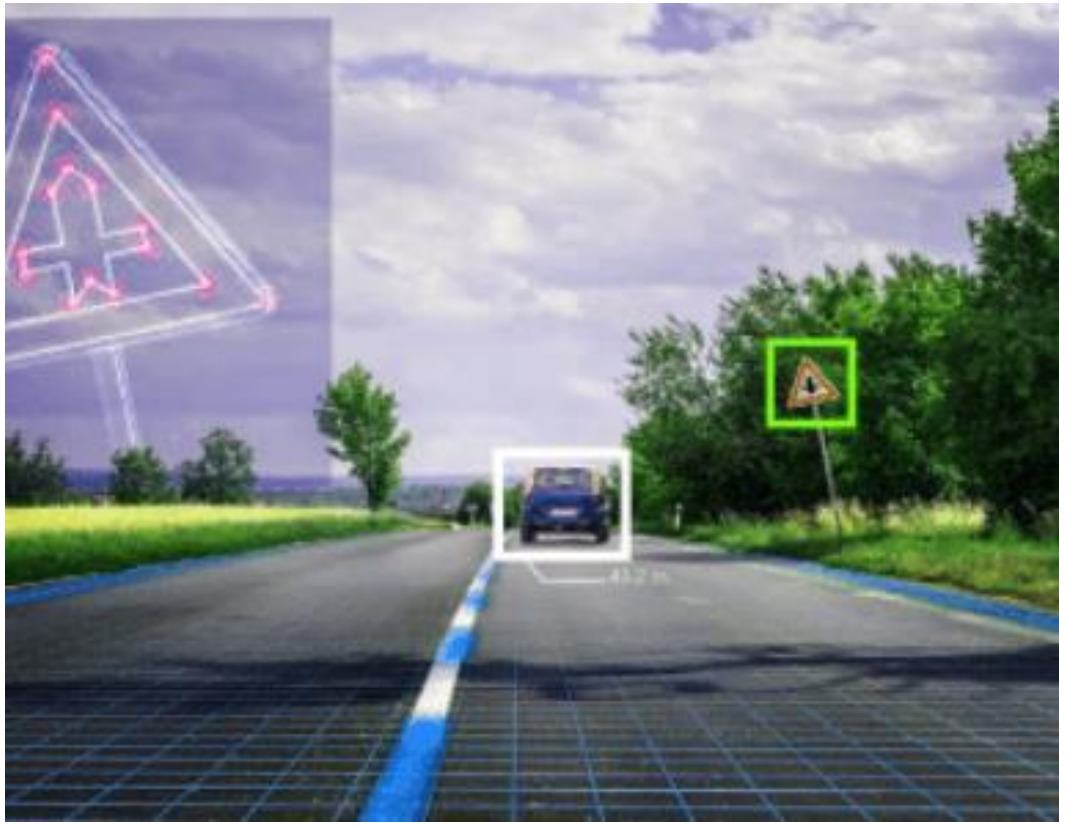
- Computer vision is quite a different field from image processing, and these two things should not be considered as being similar.
- Digital image processing is the process of creating new images from an existing image. The new images are created using special algorithms designed for achieving a specific output from an image. This includes tasks such as creating a black and white version of an image, removing noise from an image, etc. In other words, digital image processing is used for the generation of new images and does not in any way try to understand the content of an image, i.e., it has no idea what object an image contains. It only knows how to convert it from one form to another.

- Computer vision, on the other hand, is used for understanding the content of an image or a video.
- It deals with extracting useful information out of images, e.g., if an image contains a human face, whether it was taken during the day or the night, what the objects are there in the image, etc. Computer vision does not manipulate images or create new ones in any way.

Why is Computer Vision so challenging?

- Less number of images
- Poor quality of images
- Poorly labelled images
- Less variety of images
- Computing Power

This kind of computing power can be used via Cloud Computing systems, especially systems such as tensor processing units or TPUs, which are built specifically for building Machine Learning models faster. They are available to be used via Cloud Computing platforms, namely, Amazon Web Services, Google Cloud Platform, Microsoft Azure, etc.



Applications of Computer Vision

- Self-driving Cars
- Facial Recognition
- Healthcare