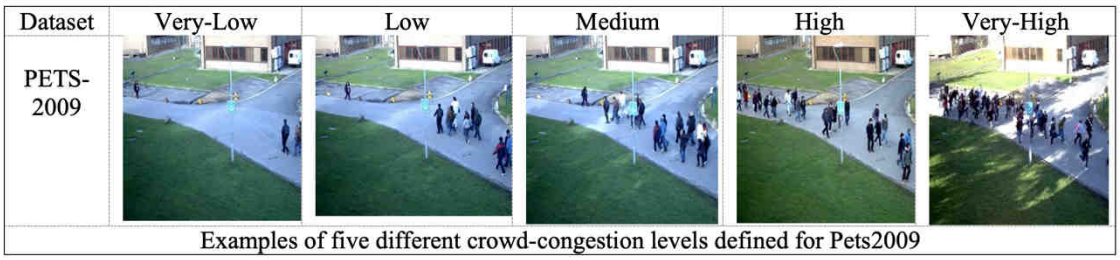
Crowd Analysis for Crowd Management

Due to the huge growth of the worldwide population, crowd analysis gains more attention not only in social but also in the technical disciplines. The crowd analysis is the basic practice to understand and interpret data based on the crowd's natural movements. We can use crowd analysis to develop crowd management strategies to avoid or minimize crowd disasters. The crowd analysis constitutes a group of related tasks but not limited to Crowd Count & Density Estimation, Crowd Behaviour Analysis, Crowd Congestion-Level Analysis, Crowd Commotion Detection, and Crowd Flow Analysis.

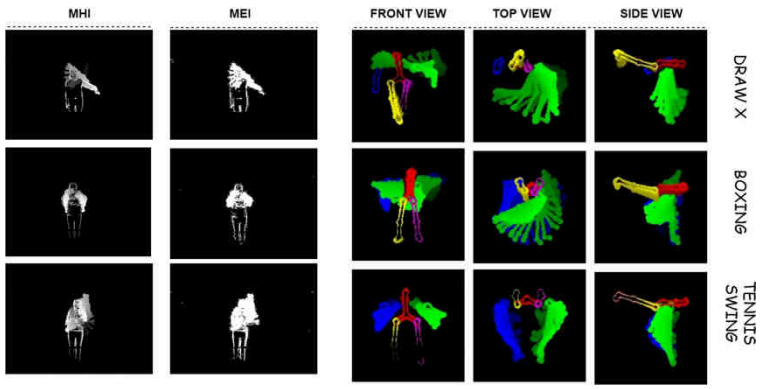
One of the main focuses of Computing and Vision Lab is to develop robust and efficient deep or hybrid models for efficient crowd analysis for crowd management.



Examples of five different crowd-congestion levels defined for Pets2009

2D/3D Human Pose Estimation

Articulated 2D/3D Human pose estimation is the task that employs computer vision techniques to estimate poses in an image. Essentially, it entails predicting the positions of a person's joints in an image or video. This problem is also sometimes referred to as the localization of human joints. Pose estimation can be performed in either 3D or 2D. This is an important task in computer vision, being used in a broad range of scientific and consumer domains, a sample of which are: (i) Human-Computer Interaction (HCI); (ii) Human-Robot Interaction; (iii) Video Surveillance; (iv) Gaming; (v) Sport Performance Analysis; (vi) Scene Understanding.

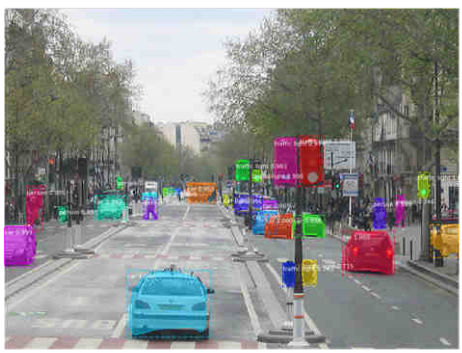


Digital Image Investigation (Image Forensics)

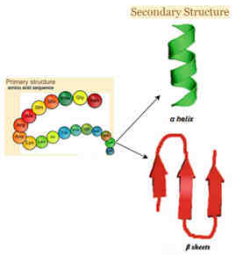
With the advancement of technology in the last two decades in the domain of digital imaging, it has become as easy as pie to alter the images. An individual with zero professional skills can edit and manipulate the photos according to his desire. Excessive development of editing tools like Adobe Photoshop can be used to manipulate original images and manipulations can be done in such a way that human eyes cannot differentiate between manipulated(forged) and original (authenticated) images. The image tampering is performed keeping the various mixed intention in their mind. Some of them are creating MEMEs (just for enjoyment), defaming various personalities, creating awareness in the society. But the ugly side is, forged images are generally used in an undesirable manner, mostly for libelling individuals from various sector of society and creating MEMEs which are very popular on social media platform these days. In this way, image authenticity can be viewed as a foremost issue. One of the main objectives of Computing and Vision Lab is to provide such a tool that can differentiate the manipulated part in an image.

Computer Vision and Machine Learning in Autonomous Vehicles

With the development of these autonomous subsystems of the car, autonomous vehicle manufacturers have already developed systems which act as assistance features on a vehicle. These systems are known as advanced driver-assistance systems and contain systems to do such actions as parallel parking and emergency braking. The technology can enable self-driving vehicles to classify and detect different objects. The vehicle can use LiDar sensors and cameras, and the former can use pulsed laser beams to measure distance. The data obtained can be combined with 3D maps to spot objects like traffic lights, vehicles, and pedestrians. These tech-oriented vehicles process such data instantly to make decisions in real-time. Thus, computer vision will enable self-driving vehicles to identify obstacles and avoid collisions and accidents. To process low light images and videos, self-driving vehicles use different algorithms than the ones used for daylight. The images captured in low light may be blurry and such data may not be accurate enough for these vehicles. As soon as the computer vision detects low-light condition it can shift to low-light mode. Such data can be obtained using LiDar sensors, thermal cameras, and HDR sensors. These types of equipment can be used to create high-quality images and videos. The self-driving vehicles can be made intelligent, self-reliant and reliable using computer vision technology. However, the vehicles may face further challenges in the development process.

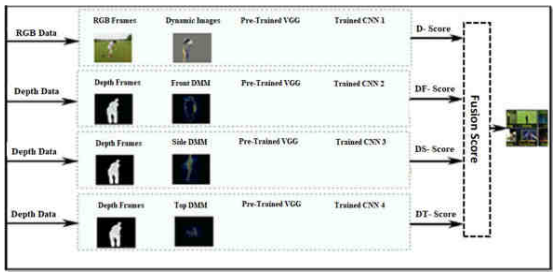


Protein Secondary Structure Prediction



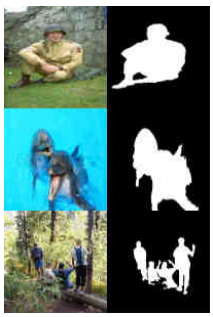
Protein secondary structure is an essential step toward understanding protein folding and its structure and function. Protein secondary structure refers to the local conformation proteins' polypeptide backbone. The protein secondary structure prediction problem is formulated as for a given protein primary sequence with amino acids character, predict whether each amino acid is in the α-helix (H), β-strand (E), or coil region (C). We focus on recent advances in deep learning and representation learning, and subsequence-based processing, which facilitates the primary sequences for secondary structure prediction.

Human Activity Recognition



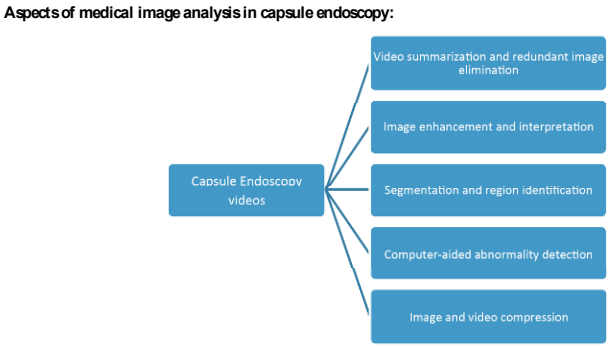
Identification of human actions from video has gathered much attention in past few years. Most of the computer vision tasks such as Health Care Activity Detection, Suspicious Activity detection, Human Computer Interactions etc. are based on the principle of activity detection. Automatic labelling of activity from videos frames is known as activity detection. Recognition of actions from video sequences is among the prime functionalities that intelligent surveillance system should be able to do. Increasing popularity of such intelligent systems is primary due to increasing applications in different domains like surveillance, human fall detection, health monitoring, human computer interaction, and for sports analysis purposes. In smart environment, there is the alert to the concerned authorities on any suspicious activities. In assisted living facilities, it allows continuous monitoring of activities of the patients. Recognition of activities from video streams involves learning activity representation or features followed by their classification. Hence, activity recognition is the problem of classifying real-world videos by human activities. In Computing and Vision Lab our focus is to design and develop state of the art models to identify the human activities in real life scenario.

Salient Object Detection (Gargi Srivastava)



The amount of increasing digital images in today's world empowers us in various ways, like photo and information sharing, medical imaging, simulation, and military purposes. Together with the empowerment, it is necessary to organize these images and use them for various computer vision purposes. One of the most critical computer vision tasks is salient object detection. Salient object detection is the process of finding important objects in an image. Humans can do this task automatically. Machines can learn to do this task by understanding the human visual attention mechanism. It has applications in various fields like an object of interest image segmentation, object recognition, content-based image retrieval, image, and video compression and video summarization. In the Computing and Vision lab methods and models are developed for salient object detection and apply it to the field of image annotation.

Abnormality detection for Capsule Endoscopy



It is a multi-disciplinary study on recent advancements in Gastrointestinal (GI) diagnosis where a capsule with a size that of a vitamin tablet when ingested will provide a video of the entire GI tract. The computer vision and machine learning algorithms are designed to accurately diagnose the abnormalities. The study involves both conventional machine learning as well as deep learning techniques. In computing and vision lab research involves design and development of an automatic abnormality detection system for capsule endoscopy.

Salient Object Detection (Suryakant Singh)

Salient object detection is to identify the most visually distinctive objects or regions in an image and then segment them out from the background. Salient object is used in various applications in Computer Vision like Object Segmentation, Video Segmentation, Object recognition and localisation, Robotic Application and Object description and other many useful applications.