Fundamentals of Video Analysis: Building Datasets and Deep Learning Systems for Recognizing Multiple Activities

Marios Pattichis
Image and Video Processing and Communications Lab
Department of Electrical and Computer Engineering
The University of New Mexico, USA
pattichi@unm.edu

1   Description

The tutorial is focused on introducing the fundamentals of developing video analysis systems for recognizing multiple activities happening at the same time. The goal of the tutorial is to provide a guide for developing custom datasets and efficient models for processing large video datasets with limited ground truth.

2   Outline

A brief outline of the topics includes:

- Fundamental problems of video analysis: face recognition, multiple activity recognition, 3D models, integration with speech recognition

- Mathematical elements: linear algebra, real analysis, statistical learning theory, multi-objective optimization

- Building video datasets

- Video analysis models

- Learning from data: unsupervised, semi-supervised, and supervised learning

- Learning with limited datasets: few-shot learning and zero-shot learning

- Emerging topics: interpretable models, learning from videos

3   Audience

The tutorial is intended to support researchers in the development of video analysis systems that can be used to process custom video datasets. The tutorial will address all aspects of the process, starting from how to build custom video datasets, to model development, and learning from data.

4   Brief Resume

Marios S. Pattichis received the B.Sc. degree with high honors and special honors in Computer Sciences, the Bachelor of Arts with high honors in Mathematics, and a minor in Electrical Engineering from the University of Texas at Austin in 1991. He received the M.S. in Electrical Engineering and the Ph.D. in Computer Engineering from the University of Texas at Austin in 1993 and 1998 respectively. He is currently a Professor and director of the image and video processing and communications lab (ivPCL) at the Department of Electrical and Computer Engineering, at the University of New Mexico.

He is currently working on the developing large-scale video analysis systems for processing educational videos and biomedical datasets. For educational videos, his goal is to develop computer assisted methods for recognizing student activities in collaborative learning videos. For biomedical video analysis, his research is focused on supporting the development of computer aided diagnosis systems for echocardiography video analysis and atherosclerotic plaque ultrasound video analysis.

He has served as a Senior Associate Editor for the IEEE Transactions On Image Processing, a Senior Associate Editor for IEEE Signal Processing Letters, Associate Editor for IEEE Transactions on Image Processing, IEEE Transactions on Industrial Informatics. He has served as a Guest Associate Editor for special issues published by the Teachers College Record, the IEEE Journal of Biomedical and Health Industry, the IEEE Transactions on Information Technology in Biomedicine, and Biomedical Signal Processing and Control. Recently, he has served as the guest editor for the special issue titled "Large-Scale Medical Image and Video Analytics for Clinical Decision Support," published by the IEEE Journal of Biomedical and Health Informatics in 2023. He was elected Fellow of the European Alliance of Medical and Biological Engineering and Science (EAMBES) for his contributions to biomedical image analysis.