Ph.D. in Information Technology:

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Fai clic qui per partecipare alla riunione

Marco Ciccone – XXXII cycle

Advisor: Prof. Matteo Matteucci
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PhD Thesis Title
On Iterative and Conditional Computation for Visual Representation Learning

Short Abstract

Learning effective representations is crucial for scaling the performance of machine learning methods. Deep Neural Networks are flexible models that can learn powerful hierarchical representations by stacking several layers of computations. However, once learned, adapting the representation to new data or behaviours is nontrivial.
With the increasing pervasiveness of intelligent systems in our daily life, it becomes of vital importance to design adaptive models that can modify their behaviour at inference time when required.
In this thesis, we take a step in the direction of learning adaptive representations for visual data addressing the problem both from a practical and theoretical perspective.
First, we study Residual Networks from a dynamical system perspective and augment them with a mechanism to automatically adapt the number of processing steps based on the characteristics of the data.
Then, we focus on the problem of learning effective asynchronous representations for event-based data. We propose a recurrent mechanism that automatically learns how to incrementally build a two-dimensional representation from events, which can be used as input to convolutional frame-based architectures to improve their performance on optical flow prediction and image recognition tasks with respect to hand-designed features.
Finally, we focus on the challenging problem of One-Shot Video Object Segmentation, where the model is asked to segment specific objects in unseen videos after observing a single annotated frame. We tackle the problem from a Meta-Learning perspective by showing that it is possible to adapt a generic meta-representation to specific task-representations, by modulating the activations of a segmentation network conditioned on the given instance.

GABRIELLI ALESSANDRO – XXXII CYCLE

Advisor: Prof. Matteo Matteucci

PhD thesis title
Studying user acceptance of autonomous driving in the wild

Short Abstract

The car's automation technology is progressing fast and has already reached a very good level of safety. Because of the advantages that autonomous cars will introduce, the question of how a driver wants to be driven becomes more and more important to ensure driving comfort for the passive driver and, so, fast and wide acceptance of this technology.

The I.DRIVE (Interaction between Driver, Road Infrastructure, Vehicle and Environment) Lab of Politecnico di Milano, where this research was conducted, aims at developing inter-disciplinary proficiency required for the analysis and modeling of behavioral aspects due to the interaction between driver, vehicle, infrastructure, and environment.
In this research thesis, we have developed a software and hardware platform that allows studying, in a real car, the interaction between driver, car, road infrastructure and environment. We focused on driver stress and the driving factors that impact driver stress to increase the little available knowledge in this field and help the acceptance of car automation in the future.
We instrumented a vehicle with different sensors to acquire vehicle's and environmental's data. To assess the driver's stress with a continuous and objective measure, we acquired the driver's physiological signals; we developed software able to acquire the sensor's signals and store them in a database. Furthermore, our software analyzes the vehicle and environmental data to extract information about the surroundings and stress indexes from the physiological data. Finally, we used the data in a correlation analysis using the K-nn algorithm to evaluate the correlation between stress indexes and driving features.
To validate our framework, six drivers performed a manual drive, an autonomous drive, and a manual drive as passengers. We validated our platform with the data acquired in these experiments. Moreover, we evaluate the correlation using our software pipeline.
Results demonstrate that longitudinal jerk, the angular velocity on x-axis, and the linear acceleration on y-axis have a high correlation with the skin conductance's phasic component and the respiration rate that are two stress indexes. The ratio between low frequency and high frequency and the heart rate of the electrocardiogram showed a low correlation with all driving features studied.

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