Aalto University

Deep Learning Methods for Image Matching

Title of the dissertation	Deep Learning Methods for Semantic Matching, Image Retrieval and Camera Relocalization
Contents of the dissertation	From robotics to augmented reality applications, the problem of image matching is a fundamental problem in computer vision. Verifying whether two images are similar or not, and if similar which parts are in correspondence can provide sufficient cues to address a wide range of autonomous scene understanding problems. For example, creating a 3D map of an environment from captured images, estimating camera motion for robust and accurate robot localization or interactive augmented reality applications etc. With the availability of large amount of data, image matching methods have drifted towards data-driven methods based on deep learning and convolutional neural networks. This opened both possibilities and challenges as data-driven methods suffer from the drawbacks of computational and memory inefficiency.
	In this thesis, we present methods that address the problem of efficiency in several important directions. Deep learning methods require large amount of labelled data that requires excessive amount of human labor and proves to be inefficient for the problem of image matching. To address this, we propose methods that allows deep learning methods to learn from small amount of training data. Furthermore, the good performance of deep learning methods is generally attributed to its large size which has a high memory footprint in computer hard-drives. This is addressed in two prominent ways. Firstly, we propose methods to reduce the number of parameters in deep learning based image matching model that effectively reduces the memory size of the model. Secondly, a generic training algorithm is proposed that allows a single deep learning model to be deployed across several environments, thereby increasing memory efficiency by reducing the requirement of storing multiple models in memory.
Field of the dissertation	Computer Science
Doctoral candidate	Zakaria Laskar (MSc Tech)
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Opponent	Professor Giorgos Tolias, Czech Technical University, Prague
Custos	Professor Juho Kannala, Aalto University School of Science, Computer Science
Electronic dissertation	*https://aaltodoc.aalto.fi/handle/123456789/47626*
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