

Thesis title : COMPUTER VISION WITH ACTIVE LEARNING

Student : Martin Kolar

Reviewer : Simon Arridge, Dept. Computer Science, University College London,

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Summary :

This thesis discusses the role of active learning in computer vision tasks. Active learning is essentially a method of selecting training data in order to optimise the given task, either by human intervention or through an automatic algorithm which itself may be based on artificial intelligence. The thesis provides reviews of this concept in chapter 2 as well as a review of machine vision more generally in chapter 3; both chapters also include the context for the thesis contributions. Chapter 4 defines the main hypothesis and contributions of the thesis which is defined in four main areas : i) Tagging of closed-domain information by optimizing an Active Learning Graphical User Interface, ii) One-shot learning with pseudolabels and a weak algorithmic expert, iii) Active Learning for human experts to create data for Generative Adversarial Neural networks, iv) Transfer Learning of algorithmic experts for Generative Adversarial Neural networks. Chapter 5 presents the main results in terms of these four areas which are demonstrated in terms of Font Capture, Unsupervised Active Learning for face generation, Optimising user annotations, and Deep Learning on small Datasets using online image search. Each of these topics has led to at least one paper published or in press. The thesis concludes with suggestions for future work and a final conclusions chapter. The bibliography contains approximately 120 citations.

Questions :

- *Is the topic appropriate to the particular area of dissertation and is it up-to-date from the view point of the present level of knowledge ?*
- Machine learning is an ever expanding topic of interest especially in machine vision applications due to the applicability of convolutional neural network architectures to develop very fast and generalised analysis tools for a plethora of problems such as segmentation, tracking, classification and multitask labelling. A critical restriction as to their wider uptake is the availability and appropriateness of training data. Thus the topic of this thesis is very timely in addressing how to augment and improve the available training data for more reliable methodology.
- *Is the work original and does it mean a contribution to the area – specify where the contribution lies.*
- There are several original aspects. One is a general framework for including labelled and unlabelled data, and for mixing supervised and semi-supervised learning techniques (called “semi-supervised” in the thesis). Contributions have been made to several problems as specified in chapter 5. Possibly the most significant is the development of methods for deep learning on small datasets.
- *Has the core of the doctoral thesis been published at an appropriate level ?*
- The thesis has resulted in 5 publications with one under review. These are a mixture of refereed journals and conference proceedings and is more than the average to be expected for a PhD candidate.
- *Does the list of the candidates publications imply that he is a person with an outstanding research erudition ?*

- The publications show an ability to contribute to diverse subject areas which shows a maturity in thinking outside of a narrow area of specialisation.

Suggestions

The student mentions briefly the relationship between Active Learning and Reinforcement Learning. The latter has an extensive literature and this point could be discussed in more detail.

In section 2.3 some notation for Support Vector Machines is presented such as margin W and $T_{0,i}$, which is not defined. Please clarify this.

In section 2.5.2 it is mentioned that the mineral dataset has 4507 distinct material spectra. This seem a really large number – do they really correspond to distinct materials, or do they represent different estimates of a small number of materials ?

Conclusion

The thesis represents a substantial body of work with appropriate level or rigour and contextualisation, and in this reviewer's opinion it meets the requirements of the proceedings leading to PhD title conferment"

Signed

Date



25-04-2021

Simon Arridge