Report
Mohamed Zarka's PhD Thesis
Fuzzy Reasoning for Multimedia Semantic Interpretation

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by

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The work presented in this thesis deals with an interesting problem in the field of video indexing and multi-media clip search. The candidate tackles the problem using a multi-media based ontology framework within the context of approximate reasoning. The motivation here is to mimic human perception behavior when presented with a sequence of inter-related visual events/concepts.

To deal with the issues, the candidate proposes a certain form of a fuzzy knowledge based framework for multimedia indexing. Enhanced interpretations of the video sequence are made through an approximate reasoning process. To handle large amount of data, a scalable version of the algorithm is developed. This is mostly based on extracting the knowledge from available multimedia information and apply to it a fuzzy ontology management based tool. For further supporting the scalability of the approach, the approximate knowledge is is extended for learning and detection of content (using a hierarchical concept detector) and semantic relationship. The candidate then goes over the implementation of the algorithm and assesses his approach using a number of publicly available datasets.

In terms of writeup and structure, the thesis is overall well written and adequately structured. There are several typos and editorial mistakes and strongly recommend the candidate to carefully proofread the thesis.

In terms of content, there are a number of contributions that have been suggested by the candidate. Although there are other competing approaches in the field, the candidate tried to use an intuitive fuzzy inferencing approach to deal with uncertain knowledge present in the sequence of scenes (not well quantified using conventional concept detection). The candidate also develops a good set of tools for

handling the scalability aspect (although part of it is mostly reproduced from well defined approaches presented in recent years in the literature).

The candidate made very good literature review and has highlighted recent work in the field. Possibly more would have been proposed especially recent approaches hihghlighted in the literature dealing with big data based video clip repositories indexing and search using online learning and domain adaptation. This is a very promising research direction and would wish to have the candidate mention it as future potential direction.

The examiner would have wished to see more powerful performance metric such as recall performance and computation requirement (algorithmic time performance). Moreover, it is very important when dealing with large data set to apply distributed/ cloud computing environment to handle real-time classification and detection of new concepts/relationship. This requires a certain type of the algorithm structure, not mentioned in details in this work. These are major issue on their own, and it is not expected the candidate to deal with all of them here. He simply needs to highlight them though in the final draft.
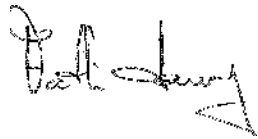
The work presented in this thesis is very timely. A lot of research work is being produced these days within the framework of big data and machine learning. Some recent approaches based on machine learning have been proven to be very powerful and the candidate needs to refer to this work. Moreover, these approaches come specifically applied to certain type of domains or classes of events (sports, movies, ads, ..). Hybrid approaches using existing solid techniques for concept detection coupled with machine learning algorithms to deal with concept relationship (context) is being proven very powerful. Candidate should mention these approaches in his references.

Although the research work in this field is still in its infancy, I felt the candidate has provided some good contribution in this thesis. A number of issues that have been raised by the examiner should not minimize what has been proposed here. The candidate has also proposed potential extension of the current work in the last chapter. I have some issues with the publication record (in terms of quantity and quality) and strongly suggest that the candidate should really work hard on publishing his work in well-known venues pertinent to the field.

In summary, I find the problem tackled here to be very pertinent in the field of video indexing and search. The candidate has done excellent literature review of existing approaches and provided some good theoretical contribution and empirical results that support well the original objectives of the thesis. Despite some shortcomings in the English write-up, lack of inclusion of very recent work dealing with big data information indexing/retrieval/search using powerful machine learning tools, and lack of strong publication record in well known venues, I command the candidate for this timely work and foresee further improvement of the approaches. The field is maturing and some of the techniques proposed here possibly combined with some recently developed machine learning tools publicly available could lead to enhanced results.

Given the overall good quality of the thesis and some of the innovative approaches proposed in this work (despite a lack of reasonably good publication record), I recommend acceptance of this work as doctoral material for his research and hence acceptance of his PhD thesis. I also strongly recommend the candidate to edit the whole thesis and improve the English write-up substantially.

Examiner

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