Situation Awareness in Colour Printing and Beyond

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DOCTORAL THESIS | Halmstad University Dissertations No. 6

Abstract

Machine learning methods are increasingly being used to solve real-world problems in the society. Often, the complexity of the methods are well hidden for users. However, integrating machine learning methods in real-world applications is not a straightforward process and requires knowledge both about the methods and domain knowledge of the problem. Two such domains are colour print quality assessment and anomaly detection in smart homes, which are currently driven by manual monitoring of complex situations. The goal of the presented work is to develop methods, algorithms and tools to facilitate monitoring and understanding of the complex situations which arise in colour print quality assessment and anomaly detection for smart homes. The proposed approach builds on the use and adaption of supervised and unsupervised machine learning methods.

Novel algorithms for computing objective measures of print quality in production are proposed in this work. Objective measures are also modelled to study how paper and press parameters influence print quality. Moreover, a study on how print quality is perceived by humans is presented and experiments aiming to understand how subjective assessments of print quality relate to objective measurements are explained. The obtained results show that the objective measures reflect important aspects of print quality, these measures are also modelled with reasonable accuracy using paper and press parameters. The models of objective measures are shown to reveal relationships consistent to known print quality phenomena.

In the second part of this thesis the application area of anomaly detection in smart homes is explored. A method for modelling human behaviour patterns is proposed. The model is used in order to detect deviating behaviour patterns using contextual information from both time and space. The proposed behaviour pattern model is tested using simulated data and is shown to be suitable given four types of scenarios.

The thesis shows that parts of offset lithographic printing, which traditionally is a human-centered process, can be automated by the introduction of image processing and machine learning methods. Moreover, it is concluded that in order to facilitate robust and accurate anomaly detection in smart

homes, a holistic approach which makes use of several contextual aspects is required.