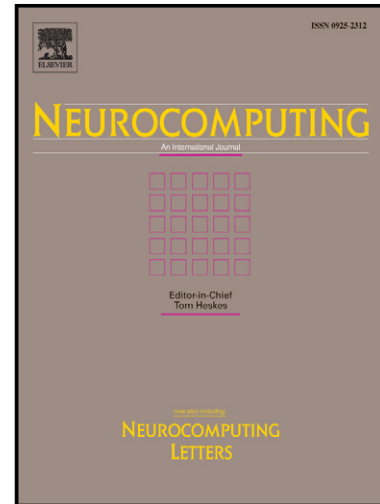


# Author's Accepted Manuscript

On The Multi-Agent Learning Neural and Bayesian Methods in Skin Detector and Pornography Classifier: An Automated Anti-Pornography System

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# On The Multi-Agent Learning Neural and Bayesian Methods in Skin Detector and Pornography Classifier: An Automated Anti-Pornography System

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**Abstract:** The main objective on this study proposed anti-pornography system works on four machine learning methods in two different stages namely skin detector stage and pornography classifier stage. A multi-agent learning is used twice. In the first stage, we proposes a multi-agent learning method that combines the Bayesian method with a grouping histogram (GH) technique and the back-propagation neural network with a segment adjacent-nested (SAN) technique based on the YCbCr and RGB colour spaces respectively, to extract skin regions from the image accurately with take into considered the problems of the light-changing conditions, skin-like colour and reflection from glass and water. In the second stage, the features from the skin are extracted to classify the images into either pornographic or non-pornographic. Inaccurate classification occurs when different image sizes are used in the existing anti-pornography systems. Thus, this paper proposes a multi-agent learning that combines the Bayesian method with a grouping histogram technique again to extract the features from the skin detection based on YCbCr colour space and the back propagation neural network method using shape features extracted again from skin detection. The classification of the pornographic images becomes more robust to the variation in images sizes. The findings from this study have shown that the proposed multi-agent learning system for skin detection has produced a significant rate of true positives (TP) (i.e., 98.44%). In addition, it has achieved a significant low average rate for the false positives (FP) (i.e., only 0.14%) while the proposed multi-agent learning for pornography classifier has produced significant rates of TP (i.e. 96%). Moreover, it has achieved a significant low average rate of FP (i.e. only 2.67%). The experimental results show that multi-agent learning in the skin detector and pornography classifier are more efficient than other approaches.

**Keywords:** Skin Detector, Pornography Classifier, Bayesian Method, Neural Network.

## 1. Introduction

The rapid development in the field of digital media has exposed us to huge amounts of non-textual information such as audio, video, and images [1, 2]. In fact, one can be easily overwhelmed by the amount of information available through electronic means [3]. More often than not, we are exposed to information that is irrelevant to our search purpose. Thus, retrieval and classification techniques have been and are continuously being developed and improved to facilitate the exchange of relevant information. In relation to this, there is a clear necessity for user-customized information selection [4, 5, 6]. In recent years, problems on the lack of control and regulation over what information can be made available, especially over the Internet; have increasingly become significant [7]. Knowledge explosion of online images and video data in digital form is impacting every aspect of life [4]. The freedom of access makes the World-Wide Web (WWW) as the most popular place where people obtain, deliver and interchange information. However, the unconstrained information delivery also brings adverse effects such as accessing illegal adult content, illegal advertisements and similar other unauthorized information. These adverse effects become more and more of a social problem as it leads to moral decadence and encourages perversion especially among youngsters who frequently watch adult images or videos. There is thus a strong case to block smut and pornography websites as a search is made. It is imperative therefore to develop efficient tools that would filter adult contents automatically [3]. There is a growing concern on filtering and blocking adult content through web indexing and browsing.

The first technique involves the collection of the adult web site addresses [8]. Once one of the prohibited web sites is accessed, the inspection software checks the rights of user and blocks the

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