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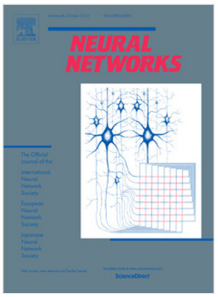

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An End to End Deep Neural Network for Iris Segmentation in Unconstrained Scenarios

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Abstract

With the increasing imaging and processing capabilities of today's mobile devices, user authentication using iris biometrics has become feasible. However, as the acquisition conditions become more unconstrained and as image quality is typically lower than dedicated iris acquisition systems, the accurate segmentation of iris regions is crucial for these devices. In this work, an end to end Fully Convolutional Deep Neural Network (FCDNN) design is proposed to perform the iris segmentation task for lower-quality iris images. The network design process is explained in detail, and the resulting network is trained and tuned using several large public iris datasets. A set of methods to generate and augment suitable lower quality iris images from the high-quality public databases are provided. The network is trained on Near InfraRed (NIR) images initially and later tuned on additional datasets derived from visible images. Comprehensive inter-database comparisons are provided together with results from a selection of experiments detailing the effects of different tunings of the network. Finally, the proposed model is compared with SegNet-basic, and a near-optimal tuning of the network is compared to a selection of other state-of-art iris segmentation algorithms. The results show very promising performance from the optimized Deep Neural Networks design when compared with state-of-art techniques applied to the same lower quality datasets.

Keywords: Deep Neural Networks, Data Augmentation, Iris Segmentation.

1 Introduction

Biometric technology has become increasingly integrated into our daily life, from unlocking the smartphone to cash withdrawals from ATMs to shopping in the local supermarket (Pando, 2017). Various biometric modalities such as face, iris, retina, voice, fingerprints, palm prints, palm geometry are being used in a multitude of applications including law enforcement, border crossing and consumer applications (Corcoran & Costache, 2016; Shejin Thavalengal & Corcoran, 2016). The iris of the human eye - the annular region between the pupil and sclera - is of particular interest as iris is a biometric modality with high distinctiveness, permanence, and performance (Prabhakar, Pankanti, & Jain, 2003).

The historical evolution of Iris recognition systems can be broadly summarised by a number of key stages, each presenting a new set of unique challenges over earlier implementations of the technology:

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