Recognition and Prominence Ranking of Alphanumeric Number Sequences in Images

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A thesis submitted in partial fulfilment of the requirements for the Bachelor of Information Technology (Honours)

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Abstract

Text detection in natural images is a growing area with increasing applications, including traffic sign and license plate recognition, and text-based image search. Robustly detecting and recognising text is especially challenging when text is deformed, such as the photometric and geometric distortions of text worn by a moving subject in unstructured scenes. Existing methods of text detection in such cases are classified as learning-based or connected component (CC)-based, applying a mix of enhanced detection techniques—such as stroke width transformation (SWT), canny-edge detection and maximally stable extremal regions (MSERs)—and feeding candidates into optical character recognition (OCR) engines or neural networks to recognise the text. This study proposes applying a learning-based approach using deep-learning strategies to automate the recognition of racing bib numbers (RBNs) in a natural image dataset of various marathons, and then ranking detected subject's photos in order of prominence. Experimental results showed that these deep-learning strategies performed favourably against other methods using a consistent dataset, prompting further investigation in the generality of the technique developed to other similar subject material.

Declarations

I certify that the the thesis entitled "Recognition and Prominence Ranking of Alphanumeric Number Sequences in Images" submitted for the degree of Bachelor of Information Technology (Honours) is the result of my own work and that where reference is made to the work of others, due acknowledgement is given. I also certify that any material in the thesis which has been accepted for a degree or diploma by any university of institution is identified in the text.

Alex Cummaudo, BSc *Swinburne*
27 October 2017

We certify that the thesis prepared by Alex Cummaudo entitled "Recognition and Prominence Ranking of Alphanumeric Number Sequences in Images" is prepared according to our expectations and that the honours coordinator can proceed to accept this submission for examination.

Prof. Rajesh Vasa
27 October 2017

Assoc. Prof. Andrew Cain
27 October 2017

Acknowledgements

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I would also like to thank Andrew Cain for his extraordinary efforts over many years to teach hundreds of students (myself included) and who has developed a valued mentorship with me in guiding me throughout my academic life.

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List of Abbreviations

CNN Convolutional Neural Network.

RBN Racing Bib Number.

Chapter 1

Introduction

1.1 Background

Alphanumeric recognition is an increasing is a growing area attracting interest from various industries and with increasing interest in academia.

1.2 Research Goals

Goal 3: *Detect RBNs using a CNN*

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Goal 3: *Design a CNN that recognises RBN sequences without character segmentation*

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Goal 3: *Rank prominence of alphanumeric sequences*

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1.3   Thesis Organisation

This thesis is organised into the chapters as outlined below.

Chapter 2 - Background Work   A literature review into the area of image processing.

Chapter 2 - Related Work   is a liter

Chapter 2

Background Work

2.1 Image Recognition

2.2 Neural Networks

Chapter 3

Related Work

3.1 RBN Recognition

3.2 Speed Limit Sign Recognition

3.3 License Plate Recognition

Chapter 4

Research Methodology

4.1 Overview

4.2 Prominence Ranking Survey

This section encapsulates an experiment to capture prominence rankings of a given sample of the dataset. In this context, prominence is defined as the prominence of a particular marathon runner is within a photo, as identified by the runner's RBN. Results gathered from this experiment will assist in developing a quantitative measure of humans identify prominence within our context. We present participants with a number of subjects and ask to rank them by a prominence Likert scale. The aggregated results of the findings are used as a prominence training dataset fed into a deep-learning neural network.

4.2.1 Survey Design

The survey published for the experiment was collected online via Google Forms[1]. The collection period was for ⟨ *number of months* ⟩ months between ⟨ *survey start date* ⟩ and ⟨ *survey end date* ⟩.

Previous chapters indicated that

Images

4.2.2 Ethics Approval

4.2.3 Demographics

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[1]`http://forms.google.com` last accessed 8 May 2017.

Chapter 5

Benchmarking

5.1 Open Source Tools

5.2 Existing Pipelines From Literature

5.3 Hermes Approach

Chapter 6

Processing Pipeline

Chapter 7

Deep Learning Comparison

Chapter 8

Validation of Results

Chapter 9

Discussion and Limitations

Chapter 10

Conclusions and Future Work

References

Appendix A

Ethics Clearance

Appendix B

Prominence Ranking Survey Results