UNIVERSITY OF OTTAWA

DOCTORAL THESIS

Efficient Intermediate Representations for Pose-Based Action Recognition

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Author:
Nicolas FLEECE

Supervisor:
Dr. Robert LAGANIÈRE

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Department of Computer Science

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UNIVERSITY OF OTTAWA

Abstract

Faculty of Engineering

Department of Computer Science

Master of Computer Science

Efficient Intermediate Representations for Pose-Based Action Recognition

by Nicolas FLEECE

The Thesis Abstract is written here (and usually kept to just this page). The page is kept centered vertically so can expand into the blank space above the title too...

"Thanks to my solid academic training, today I can write hundreds of words on virtually any topic without possessing a shred of information, which is how I got a good job in journalism."

Dave Barry

Acknowledgements

The acknowledgments and the people to thank go here, don't forget to include your project advisor…

Contents

List of Figures

List of Tables

List of Abbreviations

LAH **L**ist **A**bbreviations **H**ere

WSF **W**hat (it) **S**tands **F**or

Physical Constants

Speed of Light $c_0 = 2.997\,924\,58 \times 10^8\,\mathrm{m\,s^{-1}}$ (exact)

List of Symbols

a	distance	m
P	power	W ($\mathrm{J\,s^{-1}}$)
ω	angular frequency	rad

For/Dedicated to/To my…

Chapter 1

Literature Review

1.1 Classical Action Recognition

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1.2 Deep Learning Action Recognition

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1.2.1 3D-CNN

ResNet

MoveNet

1.3 Optical Flow

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1.4 Person-Based Action Recognition

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1.5 Pose-Based Action Recognition

Pose involves extracting the skeleton of the person and using this data over multiple frames of a video to classify an action. Pose is a common addition used in action recognition as it relates most to how humans view actions and the movement of different bones.

1.5.1 Intermediate Representations

The approach of the majority of this thesis involves creating intermediate representations for pose data over multiple frames. This typically has the aim of creating some

kind of image that represents either the motion of the persons bones and/or joints through the image at different points in the video. These images can then be used either by the model independently or added to traditional two-stream architectures.

The advantage of these types of representations is that the model can quite often be a small CNN that can be trained end-to-end very quickly and with little memory. This quite often allows for real-time evaluation and in some cases mobile-capable models.

PoTion

Pose motion representation for action recognition **choutas2018potion** was largely the inspiration for most of the work that was done within the thesis. This approach aims to take the joints extracted from the pose representation and use the movement over f frames, creating j images where j is the number of joints.

The construction of the intermediate representations is based off of joint probability locations that are provided through pose estimation models.

PA3D

Simple yet efficient real-time pose-based action recognition

Appendix A

Frequently Asked Questions

A.1 How do I change the colors of links?

The color of links can be changed to your liking using:

`\hypersetup{urlcolor=red}`, or

`\hypersetup{citecolor=green}`, or

`\hypersetup{allcolor=blue}`.

If you want to completely hide the links, you can use:

`\hypersetup{allcolors=.}`, or even better:

`\hypersetup{hidelinks}`.

If you want to have obvious links in the PDF but not the printed text, use:

`\hypersetup{colorlinks=false}`.