

Computer Vision Library for the Web (tracking.js)

by

Eduardo A. Lundgren Melo

Submitted to the Center for Informatics
in partial fulfillment of the requirements for the degree of

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Abstract

In this thesis, I designed and implemented an Augmented Reality (AR) framework to provide a common infrastructure for AR applications and to accelerate the use of those techniques on the web in commercial products. It runs on native web browsers without requiring third-party plugins installation; This involves use of several modern browser specifications as well as implementation of different computer vision algorithms and techniques into the browser environment. These algorithms can be used to detect and recognize faces, identify objects, track moving objects, etc. The source language of the framework is JavaScript that is the language interpreted by all modern browsers. The majority of interpreted languages have limited computational power when compared to compiled languages, such as C; The computational complexity involved in AR requires highly optimized implementations in order to have good results. A series of evaluation tests were made, to determine how effective these techniques were on the web.

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Acknowledgments

This is the acknowledgements section. You should replace this with your own acknowledgements [1] foo [2].

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List of Acronyms

| | |
|-------------|-------------------------------------|
| AJAX | Asynchronous JavaScript and XML |
| BAST | Bug Report Analysis and Search Tool |
| BTT | Bug Report Tracker Tool |
| BRN | Bug Report Network |
| CCB | Change Control Board |

Chapter 1

Introduction

Micro-optimization is a technique to reduce the overall operation count of floating point operations. In a standard floating point unit, floating point operations are fairly high level, such as “multiply” and “add”; in a micro floating point unit (μ FPU), these have been broken down into their constituent low-level floating point operations on the mantissas and exponents of the floating point numbers.

Chapter two describes the architecture of the μ FPU unit, and the motivations for the design decisions made.

Chapter three describes the design of the compiler, as well as how the optimizations discussed in section 1 were implemented.

Chapter four describes the purpose of test code that was compiled, and which statistics were gathered by running it through the simulator. The purpose is to measure what effect the micro-optimizations had, compared to unoptimized code. Possible future expansions to the project are also discussed.

1.1 Motivation

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1.1.1 Augmented Reality

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$$\tau(\mathbf{p}; x, y) := \begin{cases} 1 & \text{if } \mathbf{p}(\mathbf{x}) < \mathbf{p}(\mathbf{y}), \\ 0 & \text{otherwise} \end{cases}$$

1.1.2 Web

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1.1.3 Tracking

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1.1.4 Tracking on the Web

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1.2 Problem Definition

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1.3 Objectives

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1.3.1 Augmented Reality Web Framework

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exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

1.4 Thesis Structure

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Chapter 2

Basic Concepts

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2.1 Augmented Reality

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2.1.1 State of the Art

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exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

2.2 Tracking and Object Detection

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2.2.1 State of the Art

2.3 Web

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2.3.1 State of the Art

2.3.2 Problems of Augmented Reality on the Web

Chapter 3

Computer Vision Library for the Web (tracking.js)

3.1 Introduction

Supported modules: color, keypoints, rapid object detection.

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3.2 Color Tracking Algorithm

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3.3 Marker-less Tracking Algorithm (Keypoints)

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BRIEF, FAST, RANSAC.

3.4 Rapid Object Detection and Tracking Algorithm

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Viola-Jones: Features, Integral images, Learning, Detection, Training a cascade of classifiers, Training data optimization for JavaScript.

Chapter 4

Evaluation

4.1 Tools

OpenCV, JSFlartoolkit, Others. Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

4.2 Scenario Description

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4.3 Evaluation Methodology

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4.3.1 Matching Robustness

4.3.2 Occlusion Robustness

4.3.3 FPS

4.4 Results

Graphics, Analysis. Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Chapter 5

Conclusion

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5.1 Contributions

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5.2 Future Work

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exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

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