

# Curvature Estimation Algorithm's Implementation

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## Abstract

Several curvature estimators along digital contours were proposed. In this paper, we show the implementation of *Osculating Circles Estimator* and *Binomial Convolution Curvature Estimator*. After that is an approach to parallel the calculations on GPU.

## 1 INTRODUCTION

In the last lesson of Formal Design, we were given a project to finish individually. Our job is to design a sorted array in ascending order, and a method to confirm if one array is sorted.

I used a software, named **Rodin**, to do this project. There were three steps needed in this project

- Definition of an array
- Specification of a machine that will evaluate an array to see if it's sorted in ascending order
- Implementation of the machine

## 2 DGTal Library

In this project, we used DGTal for image and contour's realization. DGTal library is a project aimed at developing generic, efficient and reliable digital geometry data structures, algorithms and tools. This project is made by the cooperation between LIRIS, LAMA, LORIA, GREYC and IRCCyN.

## 3 Osculating Circles Estimator

Osculating Circles Estimator is an algorithm that calculate the curvature of a contour, by pointing out the tangent circle at each point of the contour.

For implementing this part, we used the definition of digital straight segment and digital straight line.

### 3.1 Digital Straight Line

Digital Straight Line (DSL) is defined by 4 values :  $D(a, b, \mu, \omega)$ , with  $a, b, c, d \in \mathbb{Z}$  and  $\gcd(a, b) = 1$ .  $a/b$  is called a sloped of  $D$ ,  $\mu$  is an intercept and  $\omega$  is the thickness of  $D$ .

Every points that belong to  $D(a, b, \mu, \omega)$  must satisfy :

$$\mu \leq ax - by < \mu + \omega$$

In DGTal, there are 2 types of DSL :

- Naive Digital Straight Line
- Standard Digital Straight Line

These type of DSL is made by specifying the value *thickness*.

- Naive DSL :  $\omega = \max(|a|, |b|)$
- Standard DSL :  $\omega = |a| + |b|$

### 3.2 Digital Straight Segment

Digital Straight Segment (DSS) is the set of points that belong to a digital straight line. Just like DSL, in DGTal there are also two specifics DSS : Naive DSS and Standard DSS.

### **3.3 Implementation**

## **4 CONCLUSION**

After finishing this project, I have obtained many knowledge, first of all, is the usage of *Rodin* and the way to define a system in a logical way. I have to think about the problems that I have never thought about before when programming. And most importantly, is that I could find out that all my knowledges about boolean algebra are still useful, and it could contribute to build a system in a clear and logical way.