	Graduate Candidate	Thomas Niederberger	
	Examiner	Prof. Dr. Guido Schuster	
Thomas Niederberger	Co-Examiner	Subject Area Systems	Sensor, Actuator and Communication

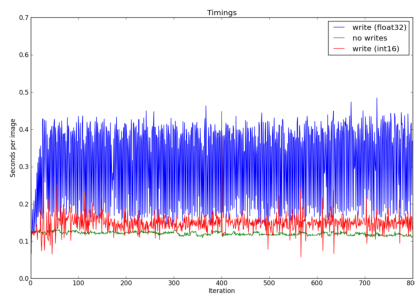# GPU Based Implementation of an Image Registration Algorithm

GPU Based Implementation of an Image Registration Algorithm for High Throughput DNA Images
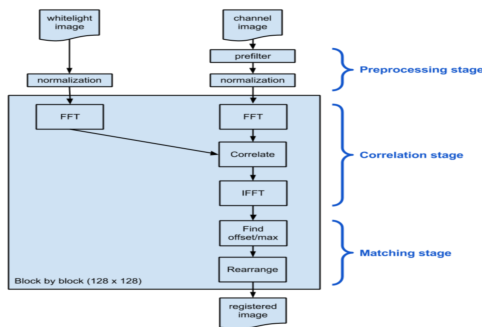
Overview over the proposed algorithm
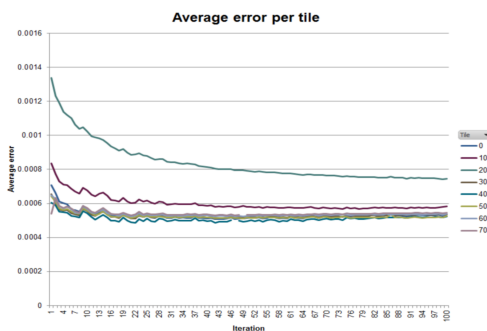
Distribution of the average errors over time

Time consumption of three different configurations over time

Introduction: The Institute for Communication Systems (ICOM) at the Hochschule fuer Technik Rapperswil (HSR) is currently developing an enhanced version of an already existing DNA sequencing solution. The DNA sequencing system takes several thousand images of chemically treated DNA strands using a high-resolution camera. From these images the DNA sequence is then estimated. Part of this system is an image registration subsystem,which is used to align images to a reference image. The algorithm for image registration is already implemented in Matlab, but not fast enough to process the images in realtime.

Objective: The main goal of the present study is to develop a GPU based implementation that makes it possible to process a data set of 30000 images within an hour. A parallel implementation based on a GPU is believed to be able to speed up the implementation in order to achieve real time capabilities. In order to do this a suiting GPU must be evaluated and acquired. The algorithm must then be ported to a platform that supports GPU programming. Finally, the GPU based implementation must be tested in regard to performance and accuracy.

Result: For the new system an AMD Radeon 7970 GHz GPU has been evaluated to be used for GPU computing. The code has then been ported to OpenCL in order to make use of GPU capabilities. The developed system has then been tested in terms of accuracy and speed. The accuracy of the developed system is high and it produces comparable results to the current system. It could be shown that real-time processing is indeed possible by making use of GPUs. The developed system is more than 40 times faster than the Matlab based system. However with the current test system it is not possible to process a complete data set in an hour, due to limited performance of hard disk operations. The current implementation needs 4521 seconds to finish processing, but replacing the hard disks with state of the art solid-state disks would allow to process all images within an hour.