

A Parallel Computing Project On
Connected Components Labelling

Submitted by

Divija Nagaraju - 14IT112

Mukta Kulkarni – 14IT220

Pooja Soundalgekar – 14IT230

V SEM B.Tech (IT)

Under the Guidance of

Dr Geetha V.

Assistant Professor

in partial fulfillment for the award of the degree

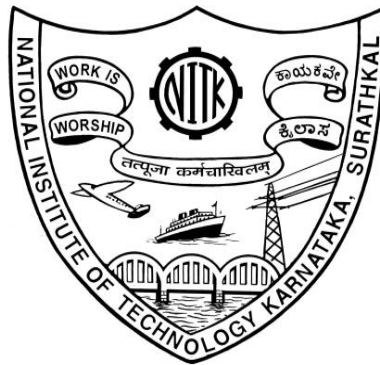
of

Bachelor of Technology

In

Information Technology

At



Department of Information Technology

National Institute of Technology Karnataka, Surathkal

November 2016

CERTIFICATE

This is to certify that the project entitled “Connected Component Labelling” is a bonafide work carried out as part of the course Parallel Computing (IT300), under my guidance by

1. Divija Nagaraju – 14IT112
2. Mukta Kulkarni - 14IT220
3. Pooja Soundalgekar - 14IT230

students of V Sem B.Tech (IT) at the Department of Information Technology, National Institute of Technology Karnataka, Surathkal, during the academic semester Jul - Dec 2016 in partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in Information Technology, at NITK Surathkal.

Place:

Date:

Signature of the Instructor

ACKNOWLEDGEMENT

We would like to take this opportunity to thank and express our gratitude to all those without whom the completion of this project would not have been possible. This project has helped expand our horizons and improved our analytical skills. We would like to extend our thanks to our project advisor and project co-ordinator, Dr Geetha V., Department of Information Technology for her constant help and support. We express my heartfelt gratitude to our HOD, Dr. Ram Mohan Reddy Department of Information Technology who has extended support, guidance and assistance for the successful completion of the project. Finally, we would like to thank all our classmates, friends and seniors for their suggestions and support.

Divija Nagaraju

Mukta Kulkarni

Pooja Soundalgekar

ABSTRACT

Connected-component labelling (alternatively called region extraction) is an algorithmic application of graph theory, where subsets of connected components are uniquely labelled based on a given heuristic. It is used in computer vision to detect connected regions in binary digital images, although colour images and data with higher dimensionality can also be processed.

Connected component labelling methods are classified into 4 different categories:

- Repeat pass, one component at a time
- Two Pass way
- Hierarchical Tree structure
- Mesh and hypercube parallel processors.

This project is a parallel implementation of Suzuki's and Two pass algorithm i.e. the concepts mentioned in the first two categories.

TABLE OF CONTENTS

1. Introduction.....	1
2. Literature Survey.....	2
3. Problem Definition.....	3
4. Requirements and Design.....	4
5. Sequential Code.....	5-7
6. Implementation.....	8-10
6.1 Multi pass Algorithm.....	9
6.2 Two pass Algorithm.....	9-10
6.3.1 Scanning phase.....	10
6.3.2 Analysis phase.....	10
6.3.3 Labelling phase.....	10
7. Results and Discussions.....	11-13
8. Conclusion and Future Work.....	14
References	

LIST OF FIGURES

Figure 6.1: Description of an 8-connected neighbourhood and forward and backward scan masks.....	8
Figure 6.2: Example of the Suzuki's algorithm with 2 threads.....	9
Figure 7.1: Execution speed up versus number of threads used for large images.....	13

REFERENCES

- [1] *Haralick RM* Some neighbourhood operations. Plenum Press, New York, pp 11–35, 1981
- [2] *Suzuki K, Horiba I, Sugie N* Linear-time connected-component labelling based on sequential local operations. *Comput Vis Image Underst* 89(1), 2003
- [3] *Mehdi Niknam, Parimala Thulasiraman, Sergio Camorlinga* A Parallel Algorithm for Connected Component Labelling of Gray-scale Images on Homogeneous Multicore Architectures , 2010
- [4] *Lifeng He, Yuyan Chao, Kenji Suzuki* A New Two-Scan Algorithm for Labelling Connected Components in Binary Images, 2012
- [5] *Kesheng Wu, Ekow Otoo, Kenji Suzuki* Optimizing two-pass connected-component labeling algorithms, 2008