



**School of Computer Engineering**

***Bioinformatics Research Centre  
(BIRC)***

**ANNUAL REPORT 2010**

**Director: Prof Jagath C. Rajapakse**

**School of Computer Engineering  
Nanyang Technological University  
Block NS4-04-33  
50 Nanyang Avenue  
Singapore 639798**

## Contents

|       |  |    |
|-------|--|----|
| 1.    | Introduction .....                       | 1  |
| 1.1   | Mission and Vision .....                 | 1  |
| 1.2   | Research Interests.....                  | 1  |
| 2     | Members.....                             | 2  |
| 2.1   | Steering Committee .....                 | 2  |
| 2.2   | Core faculty .....                       | 2  |
| 2.3   | Affiliated faculty.....                  | 2  |
| 2.4   | Researchers.....                         | 2  |
| 2.5   | Graduate Students .....                  | 3  |
| 2.6   | Ph.D. Completed .....                    | 5  |
| 2.7   | Master’s Degrees Awarded.....            | 5  |
| 3     | Outcomes.....                            | 5  |
| 3.1   | Awards and Honours.....                  | 5  |
| 3.1.1 | Awards and Honours (Faculty).....        | 5  |
| 3.1.2 | Awards and Honours (Students).....       | 5  |
| 3.1.3 | Awards and Honours (Staff).....          | 5  |
| 3.2   | Talks .....                              | 5  |
| 3.3   | Editorial activities.....                | 6  |
| 3.4   | Conference activities.....               | 6  |
| 3.5   | Other Professional Activities.....       | 7  |
| 3.6   | Symposiums and Workshops organized ..... | 7  |
| 3.7   | Grants.....                              | 8  |
| 4     | Publications.....                        | 10 |
| 4.1   | Books.....                               | 10 |
| 4.2   | Journal Papers.....                      | 10 |
| 4.3   | Edited Books .....                       | 12 |
| 4.4   | Book chapters .....                      | 12 |
| 4.5   | Refereed Conference Papers .....         | 13 |
| 5     | Statistics 2010 .....                    | 16 |
| 6     | Collaborators.....                       | 17 |

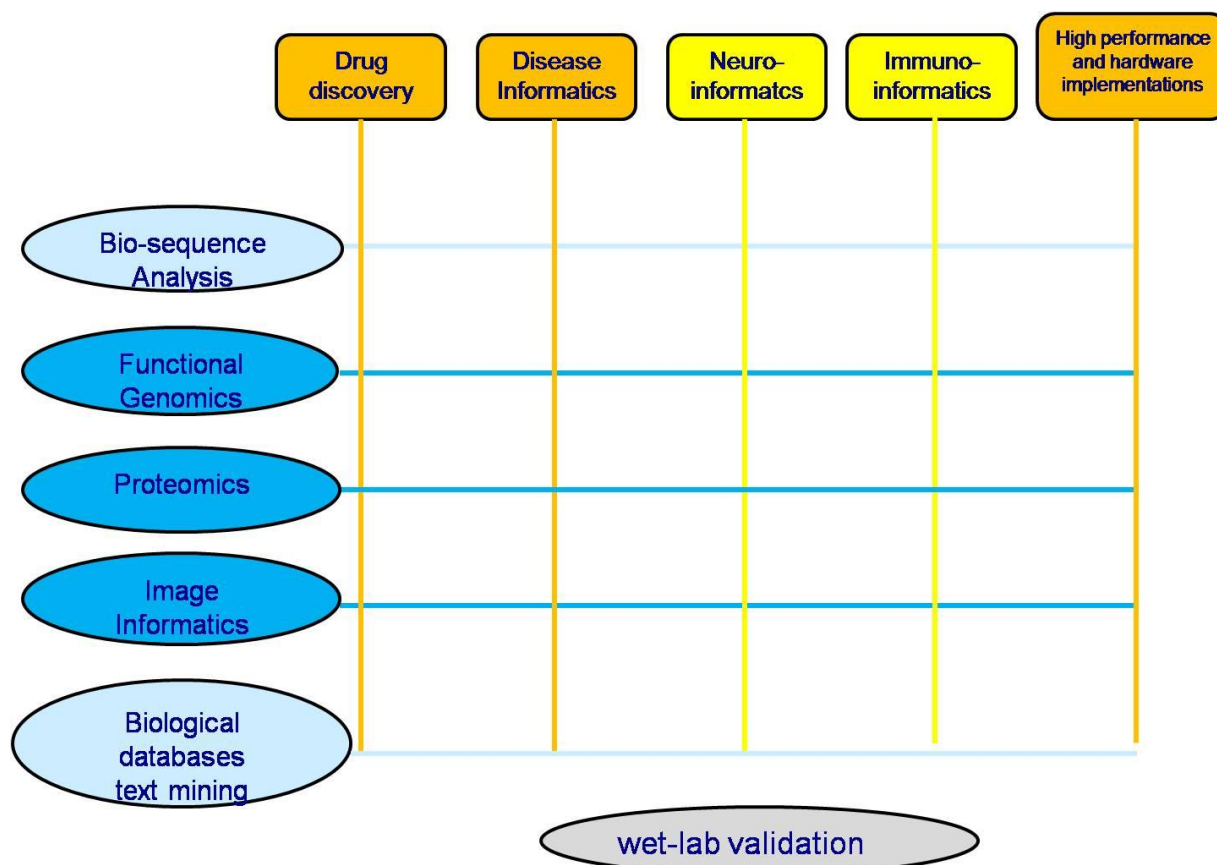
# 1. Introduction

## 1.1 Mission and Vision

Our Mission is to provide the environment and training to engage in leading and cutting edge research in computational biology and bioinformatics, and thereby become a part of the life sciences forces in Singapore and elsewhere.

Our Vision is to dedicate to the advancement of bioinformatics through education, research, and scientific breakthroughs, leading to discoveries of novel medical drugs and therapies.

## 1.2 Research Interests



## 2 Members

### 2.1 Steering Committee

Assoc Prof Kwoh Chee Keong  
Asst Prof Jung-jae Kim  
Prof Jagath C. Rajapakse  
Assoc Prof Bertil Schmidt

Secretary  
Chair

### 2.2 Core faculty

Asst Prof Manoranjan Dash                      SCE  
Assoc Prof Lin Feng                                SCE  
Asst Prof Steven Chu Hong Hoi                SCE  
Assoc Prof Kwoh Chee Keong                    SCE  
Asst Prof Jung-jae Kim                            SCE  
Asst Prof Jagdish C. Patra                        SCE  
Prof Jagath C. Rajapakse                        SCE  
Assoc Prof Bertil Schmidt                        SCE

### 2.3 Affiliated faculty

Assoc Prof Sourav S. Bhowmick                SCE  
Asst Prof Jie Zhang                                SCE  
Asst Prof Kuiyu Chang                            SCE

### 2.4 Researchers

| Name                         | Title              | Project title  | Supervisor           | School  | Duration                |
|------------------------------|--------------------|--|----------------------|---------|-------------------------|
| Dr. Chen Peng                | Research Fellow    | Protein binding and interaction                                    | Hoi Chu Hong, Steven | SCE     | 2009/04/09 – 2010/12/31 |
| Dr. Cheng Jierong            | Research Fellow    | Data Mining & Microscopic Image Analysis                           | Jagath C. Rajapakse  | SCE/SMA | 2007/07/15 –            |
| Mr. Stephanus Daniel Handoko | Project Officer    | Predicting Protein–Small-molecule Interactions from PDB Structures | Kwoh Chee Keong      | SCE     | 2010/01/29/             |
| Ms. Divya Jain               | Research Associate | Validation of delays in gene regulatory network                    | Jagath C. Rajapakse  | SCE     | 2009/09/14              |

|                                  |                    |   |                      |         |                               |
|----------------------------------|--------------------|---|----------------------|---------|-------------------------------|
| Mr. Alvin Ng                     | Project Officer    | Tissue System Biology   | Jagath C. Rajapakse  | SCE/SMA | 2010/09/30<br>–<br>2011/01/31 |
| Mr. Perumal Anadagopu            | Research Associate | Contribution of hydrophobic residues in stability on Genome, transcriptome and proteome | Hoi Chu Hong, Steven | SCE     | 2009/07/09<br>–               |
| Ms. Shamima Banu Binte SM Rashid | Research Assistant | Protein-RNA interactions from a structural perspective                                  | Hoi Chu Hong, Steven | SCE     | 2010/02/01                    |
| Mr. Adrianto Wirawan             | Project Officer    | Heterogeneous Multicore Systems for Bioinformatics                                      | Kwoh Chee Keong      | SCE     | 2010/05/27                    |
| Mr. Wu Min                       | Project Officer    | Core Attachment based Mining for Protein complexes and small molecule                   | Kwoh Chee Keong      | SCE     | 2010/08/11                    |
| Dr. Xie Zhipeng                  | Research Fellow    | Unraveling the Topologies of Discovered Protein Complexes via Information Integration   | Kwoh Chee Keong      | SCE     |                               |
| Ms. Merlin Veronika              | Project Officer    | Tissue System Biology   | Jagath C Rajapakse   | SCE/SMA | 2010/09/30<br>–<br>2011/01/31 |

## 2.5 Graduate Students

| Name            | Title             | Project Title   | Supervisor         | School  | Duration     |
|-----------------|-------------------|---|--------------------|---------|--------------|
| Zheng Bo        | Ph.D.             | Human brain diffusion weighted image processing                                     | Jagath C Rajapakse | SCE     | 2005 -       |
| Angela Jean     | Ph.D. (Part-time) | Phylogeny Analysis for the Determination of Interacting Partners                    | Lin Feng           | SCE     | 2008/08      |
| Iti Chaturvedi  | Ph.D.             | Predicting gene regulatory networks from time course gene expression                | Jagath C Rajapakse | SCE     | 2006/09<br>– |
| Kavuri Swathi   | Ph.D.             | Evolutionary Approaches to ICA-R and application to Brain Signal Processing         | Jagath C Rajapakse | SCE     | 2007/01<br>– |
| Cheong Lee Sing | Ph.D. (Part-time) | Structural Analysis of Genomic Sequences Using Digital Signal Processing Technology | Lin Feng           | SCE     | 2006/01<br>– |
| Alvin Ng        | Ph.D.             | Analysis of drug treated morphological responses from HCS imaging                   | Jagath C Rajapakse | SCE/SMA | 2006/08<br>– |

|                          |                   |   |                                    |          |                   |
|--------------------------|-------------------|---|------------------------------------|----------|-------------------|
| Merlin Veronika          | Ph.D.             | Developing cell profiling method to identify sub-populations/cell phases from high content images                         | Jagath C Rajapakse                 | SCE/ SMA | 2006/08 –         |
| Li Yongjin               | Ph.D.             | Identification of disease genes by combining heterogeneous data sources   | Jagdish Patra                      | SCE      | 2007/08 – 2010/09 |
| Mundra Piyushkumar       | Ph.D.             | Feature Selection for Classification of Gene Expression Data  | Jagath C Rajapakse                 | SCE      | 2007/01 – 2011/01 |
| Xu Shuoyu                | Ph.D.             | Image analysis for high throughput cytological profiling from tissue microscopic images in fibrosis                       | Jagath C Rajapakse                 | SCE/ SMA | 2007/09 –         |
| Zhu Shiwen               | Ph.D.             | Analyzing Cytoskeletal Protein Colocalization from High-Content   | Jagath C Rajapakse                 | SCE/ SMA | 2007/09 –         |
| Fransiskus Xaverius Ivan | Ph.D.             | Molecular basis of lung damage-repair under influenza virus infection   | Jagath C Rajapakse                 | SCE/ SMA | 2008/08 –         |
| Piao Haiyan              | Ph.D.             | Microarray Data Analysis for Cancer Diagnosis   | Jagdish Patra                      | SCE      | 2008/01 –         |
| Liu Qian                 | Ph.D.             | Computational Analysis on Protein Binding and Interactions --- A Water Exclusion Perspective                              | Hoi Chu Hong, Steven               | SCE      | 2007/12 –         |
| Zhao Liang               | Ph.D.             | B-Cell epitope prediction   | Hoi Chu Hong, Steven               | SCE      | 2008/08 –         |
| Liu Song                 | Ph.D.             | Automated cellular and tissue image processing for subcellular protein localization                                       | Jagath C Rajapakse                 | SCE      | 2006 –            |
| Arun Kumar               | Ph.D. (Part-time) | Time-frequency analysis of functional MR images   | Jagath C Rajapakse                 | SCE      | 2005/ 02 –        |
| Lakshmi Venkatraman      | Ph.D.             | Mathematical Model of Transforming-growth factor Beta -1 activation and role of dynamics in progression of liver fibrosis | Sourav Bhowmick                    | SCE/ SMA | 2006 –            |
| Adrianto Wirawan         | Ph.D.             | Whole Genome Discovery of Transcriptional Regulatory  | Kwoh Chee Keong and Bertil Schmidt | SCE      | 2006/06           |
| Li Zhenhua               | Ph.D.             | Protein-protein interaction and protein binding hot spots   | He Ying                            | SCE      | 2009/01 –         |
| Lei Lin                  | Ph.D.             | The usage of biomedical ontology for text mining  | Jung-Jae Kim                       | SCE      | 2009/01 –         |
| Yang Peng                | Ph.D.             | Core-Attachment based Mining for Protein Complexes & Small-molecule Interactions  | Kwoh Chee Keong                    | SCE      | 2010/01           |
| Su Tran To Chinh         | Ph.D.             | Drug and drug-target investigation via small-molecule interaction.  | Kwoh Chee Keong                    | SCE      | 2010/01           |
| Thidathp Wongsurawat     | Ph.D.             | Computational Analysis and Prediction of Specific Genomic   | Kwoh Chee Keong                    | SCE      | 2010/01           |

|                |                  |   |                 |     |         |
|----------------|------------------|---|-----------------|-----|---------|
|                |                  | Regions Forming Triplexes and Chromosomal Variations Associated with Cancer |                 |     |         |
| Ouyang Xuchang | Ph.D.            | Accelerate the Protein-Ligand Docking                                       | Kwoh Chee Keong | SCE | 2010/08 |
| Zhang Zhuo     | Ph.D.(Part-time) |   | Kwoh Chee Keong | SCE |         |

## 2.6 Ph.D. Completed

Piyush Mundra  
Li Yongjin

## 2.7 Master's Degrees Awarded

Nil

## 3 Outcomes

### 3.1 Awards and Honours

#### 3.1.1 Awards and Honours (Faculty)

Nil

#### 3.1.2 Awards and Honours (Students)

- *Best Student Paper Award*, P.Mundra and J.C. Rajapakse, "Support Vectors Based Correlation Coefficient for Gene and Sample Selection in Cancer Classification", 2010 IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology, Montreal, 2010
- *Student Travel Grant*, IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology, Montreal, Canada, 2010. (Piyush Mundra)

#### 3.1.3 Awards and Honours (Staff)

- *Einstein Award for Scientific Achievement Individual in the Arena of Bioinformatics*, International Biographical Centre, Cambridge, UK , 12th March 2010. (Perumal Anandgopu)

### 3.2 Talks

- Invited Talk: "*Trends in biomedical text mining for knowledge discovery*", 9th Korea-Singapore Workshop on Bioinformatics and Natural Language Processing, Daejeon, South Korea, Feb. 2010. (Jung-jae Kim)
- Invited Talk: "*Cell profiling for staging tissues with high content imaging*," 6th World Congress in Biomechanics (WCB 2010), Singapore, August 1 - 6 (Jagath C. Rajapakse)
- Plenary Talk: "*Modeling neural systems from functional brain imaging*," 10th International Conference on Artificial Intelligence and Soft Computing (ICAISC 2010), Zakopane, Poland, June 13-17 (Jagath C. Rajapakse)

- Plenary Talk “*Pattern recognition in Bioinformatics,*” Bioinformatics in Torun (BIT 2010) Conference, Torun, Poland, June 10-12 (Jagath C. Rajapakse)

### 3.3 Editorial activities

- *Editor, Journal of Biomedical Semantics* (Jung-jae Kim)
- *Editorial Board, International Journal of Computational Sciences* (Bertil Schmidt)
- *Editorial Board, BMC Research Notes* (Bertil Schmidt)
- *Editorial Board, Advances in Bioinformatics* (Jagath C. Rajapakse)
- *Editorial Board, International Journal of Functional Genomics and Personalized Medicine* (Jagath C. Rajapakse)
- *Associate Editor, IEEE/ACM Transactions on Computational Biology and Bioinformatics* (Jagath C. Rajapakse)
- *Associate Editor, IEEE Transactions on Medical Imaging* (Jagath C. Rajapakse)
- *Associate Editor, IEEE Transactions on Neural Networks* (Jagath C. Rajapakse)
- *Associate Editor, IEEE Transactions on Computational Biology and Bioinformatics* (Jagath C. Rajapakse)
- *Editorial Board Member, Neural Information Processing – Letters and Reviews* (Jagath C. Rajapakse)
- *Associate Editor, Journal of VLSI Signal Processing* (Lin Feng)
- *Member of Editorial Board, Journal of Signal Processing Systems, Springer* (Lin Feng)
- *Associate Editor, Journal of Medical Imaging and Health Informatics, American Scientific Publishers* (Lin Feng)
- *Editorial Board, The Open Biomarkers Journal, Bentham Science Publishers* (Lin Feng)
- *Editorial Board, The Open Virtual Reality Journal, Bentham Science Publishers* (Lin Feng)
- *Editorial Board, The Open Software Engineering Journal, Bentham Science Publishers* (Lin Feng)
- *Editorial Advisory Board, The Open Software Engineering Journal* (Chang Kuiyu)
- *Editorial Advisory Board, The Open Artificial Intelligence Journal* (Chang Kuiyu)
- *Editorial Board, Theoretical Biology Insights* (Kwoh Chee Keong)
- *Editor, Bioinformation* (Kwoh Chee Keong)

### 3.4 Conference activities

- *Faculty Advisor, BIRC Student Symposium 2010, SCE, NTU*(Jung-jae Kim)
- *Steering Committee, Bioinformatics Research Centre (BIRC), NTU, 2010* (Jung-jae Kim)
- *Session Chair, International Conference on Intelligent Systems for Molecular Biology (ISMB 2010), Technology Track, Boston, MA, USA 2010*(Jung-jae Kim)
- *Program Committee, International Conference on Web Intelligence, Mining and Semantics, 2011.* (Jung-jae Kim)
- *Reviewer, IEEE Transactions on Knowledge and Data Engineering, 2010.* (Jung-jae Kim)
- *Program Committee, 4th International Symposium on Semantic Mining in Biomedicine, 2010.* (Jung-jae Kim)
- *Steering Committee, International Conference on Language Resources and Evaluation (LREC), 2010.* (Jung-jae Kim)
- *Workshop Organizer, IEEE International Conference on Communication Systems (ICCS), Singapore* (Bertil Schmidt)



- *Program Committee*, Annual International Conference on Real-Time and Embedded Systems (RTES 2010), Singapore, 1-2 November 2010(Lin Feng)
- *Judge*, A-Star Talent Search & Singapore Science and Engineering Fair 2010(Lin Feng)
- *Program Committee*, 28th International Conference on Machine Learning, Bellevue Washington, 2011 (Hoi Chu Hong, Steven)
- *Program Committee* , 4th ACM WSDM Conference, Hong Kong, 2011 (Hoi Chu Hong, Steven)
- *Program Committee Member*, 16<sup>th</sup> ACM SIGKDD Conference on knowledge Discovery and Data mining , Washington DC ,2010 (Hoi Chu Hong, Steven)
- *Program Committee*, IEEE Asia Pacific Conference on Circuits and Systems, Kuala Lumpur, Malaysia (Chang Kuiyu)
- *Program Committee*, IEEE International Conference on Information and Security Informatics, Vancouver, Canada(Chang Kuiyu)
- *Invited Workshop Participant*, 2010 Korea-Singapore Workshop on Bioinformatics and Natural Language Processing, KAIST, Daejon, Korea (Chang Kuiyu)
- *Chair, Steering Committee*, International Conference on Pattern Recognition in Bioinformatics (PRIB) (Jagath C Rajapakse)
- *Committee Member*, 4th Asian Young Researchers Conference on Computational and Omics Biology (Stephanus Daniel Handoko)

### **3.5 Other Professional Activities**

- *Reviewer, Grants and Fellowships*, National Research Foundation (NRF), Singapore(Jagath C Rajapakse)
- *Grant Reviewer*, Medical Research Council (MRC), UK(Jagath C Rajapakse)
- *Fellow*, American Institute for Medical and Biological Engineering (AIMBE) (Jagath C Rajapakse)
- *Fellow*, Singapore-MIT Alliance for Research and Technology (SMART) (Jagath C Rajapakse)
- *Fellow*, Singapore-MIT Alliance (SMA) (Jagath C Rajapakse)

### **3.6 Symposiums and Workshops organized**

- *Symposium* , Joint SBS/SCE Research Symposium, Jun 25<sup>th</sup> ,2010
- *Symposium*, BIRC student symposium on Bioinformatics, Nov 13<sup>th</sup> ,2010
- *Workshop*, The 4th Virtual Training Workshop on Bioinformatics, Sep 27<sup>th</sup> 2010 – Dec 10<sup>th</sup> 2010

### 3.7 Grants

| Project Title   | Funding Agency                          | Grant Amount (\$\$)                 | Partner Organization and Collaborators | NTU PI(s)               | Start and end dates     |
|---|---|-------------------------------------|--|-------------------------|-------------------------|
| Quasi-bipartite Graphs for Modelling Protein Binding Sites and Their Functional Homogeneity Study                   | MOE Tier-1                              | \$130,000                           | HUST, SCUT                             | Hoi Chu<br>Hong, Steven | 03/2008<br>–<br>03/2011 |
| The Protein Binding Hot Spots Are Water Free?   | MOE Tier-2                              | \$730,020                           | HUST, SCUT                             | Hoi Chu<br>Hong, Steven | 12/2008<br>–<br>12/2011 |
| A Novel Core-Attachment based Mining Technique: to detect Protein Complexes and Protein-Small Molecule Interactions | MOE Tier-2                              | \$1,000,320.00                      | IBM, NUS,<br>SGH, GIS                  | Kwoh Chee<br>Keong      | 05/2009<br>–<br>05/2012 |
| Structural Analysis and Characterization of Protein Complexes   | Jardine OneSolution, IBM and Novaglobal | \$14,018.69                         | IBM                                    | Kwoh Chee<br>Keong      | 05/2009<br>–<br>05/2012 |
| Advanced Image Computational Analysis   | Singapore-MIT Alliance                  | \$1,639,560 (includes 5 RSS awards) | MIT, SMART Singapore, NUS, SigN, IMB   | Jagath Rajapakse        | 07/2002<br>–            |
| Development of scalable algorithms and tools for emerging sequencing technologies                                   | MOE Tier-2                              | \$150,000                           |  | Bertil Schmidt          | 05/2009<br>–<br>05/2012 |
| GPU-enable genomics   | NVIDIA Inc.                             | \$25,000                            | NVIDIA                                 | Bertil Schmidt          | 10/2008<br>–<br>09/2010 |
| Start-up grant  | NTU                                     | \$100,000                           |  | Jung-jae Kim            | 2010                    |
| An Immersive Virtual Endomicroscopic Environment-Towards Innovation in Photodynamic Therapy for Mucosal Cancer      | NTU/IMI                                 | \$100,000                           |  | Lin Feng                | 2010 -                  |
| Multi-Modal Medical Imaging and Informatics for PACS  | NTU/NITHM                               | \$100,000                           |  | Lin Feng                | 2010 –                  |

|  |  |             |                            |                            |                         |
|--|--|-------------|----------------------------|----------------------------|-------------------------|
| & RIS  |  |             |                            |                            |                         |
| Real-time Diagnostic Endomicroscopy  | AcRF, RGM  | \$70,000    |                            | Lin Feng                   | -2010                   |
| Cellular Fluorescence Imaging with Endomicroscopy                                | AcRF   | \$42,370    |                            | Lin Feng (Co-Investigator) | -2010                   |
| Modelling, Validation, and Analysis of Gene Regulatory Networks including Delays | AcRF Tier 2  | \$1,191,620 |                            | Jagath C Rajapakse         | 12/2010<br>-<br>12/2013 |
| SMART Fellow Award   | Singapore-MIT Alliance for Research and Technology Center        | S\$10,000   |                            | Jagath C Rajapakse         | 12/2011<br>-<br>12/2012 |
| Statistical study of data from EDEN study  | SMART Infectious Disease IRG grant SMART Center, Singapore       | \$12,450    | Prof Steve Tennenbaum, MIT | Jagath C Rajapakse         | 08/2010<br>-<br>03/2011 |
| Image informatics for liver fibrosis   | BioSystems and micromechanics IRG grant, SMART Center, Singapore | \$225,000   | Prof Peter So              | Jagath C Rajapakse (Co-PI) | 03/2010<br>-<br>02/2012 |

## 4 Publications

### 4.1 Books

1. B. Schmidt (Editor): *Bioinformatics: High Performance Parallel Computer Architectures*, Taylor & Francis/CRC Press, July 2010

### 4.2 Journal Papers

1. J.C. Patra, and B. H. Chua, "Neural Networks-based Drug Design for Diabetes Mellitus Using Flavonoids," *Journal of Computational Chemistry*, available online: <http://onlinelibrary.wiley.com/doi/10.1002/jcc.21641/abstract> DOI: 10.1002/jcc.21641. (IF= 3.77)
2. Y. Li and J. C. Patra, "Genome-wide inferring gene-phenotype relationship by walking on the heterogeneous network," *Bioinformatics*, vol. 26, no. 9, pp. 1219-1224, May 2010. (IF= 4.93)
3. Y. Li and J. C. Patra, "Integration of multiple data sources to prioritize candidate genes using discounted rating system," *BMC Bioinformatics*, 11(Suppl 1):S20, 2010, available online: <http://www.biomedcentral.com/1471-2105/11/S1/S20> (IF= 3.43)
4. W-X. Zhang, L. Tucker-Kellogg, B C Narmada, L. Venkatraman, S. Chang; Y. Lu; N.Tan; J K White; C F Dewey, S.S Bhowmick, P. So, S Shen, H. Yu. "Cell-Delivery Therapeutics for Liver Regeneration", *Advanced Drug Delivery Reviews (ADDR)*, 62(7-8), Elsevier Science, June 2010. (IF= 8.3)
5. J. Cheng, E. G. L. Koh, S. Ahmed, and J. C. Rajapakse, "Tracking Actin-based Cell Protrusions with Filopodia", submitted to *IEEE Transactions on Medical Imaging*. (IF= 3.540)
6. A. Perumal, S. Banu and J. Li ,Low Thymine Content in PINK1 mRNAs and Insights into Parkinson's Disease. *Bioinformation*. 4, 452-455,2010.
7. W. Liu, B. Schmidt, W. Mueller-Wittig,"CUDA-BLASTP: Accelerating BLASTP on CUDA-enabled Graphics Hardware", *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, to appear
8. Y. Liu, B. Schmidt, D. Maskell, "MSAProbs: multiple sequence alignment based on pair hidden Markov models and partition function posterior probabilities", *Bioinformatics*, Vol. 26, No. 16, pp. 1958-1964, 2010 (IF= 4.926)
9. A. Wirawan, C.K. Kwoh, B. Schmidt, "Multi Threaded Vectorized Distance Matrix Computation on the Cell/BE and x86/SSE2 Architectures", *Bioinformatics*, Vol. 26, No. 10, pp. 1368-1369, 2010 (IF= 4.926)
10. Y. Liu, B. Schmidt, D. Maskell, "CUDASW++2.0: enhanced Smith-Waterman protein database search on CUDA-enabled GPUs based on SIMT and virtualized SIMD abstractions", *BMC Research Notes*, 3:93, 2010
11. H. Shi, B. Schmidt, W. Liu, W. Mueller-Wittig, "A Parallel Algorithm for Error Correction in High-Throughput Short-Read Data on CUDA-enabled Graphics Hardware", *Journal of Computational Biology*, 17(4) pp. 603-615, 2010 (IF= 1.694)

12. Y. Liu, B. Schmidt, W. Liu, D. Maskell, "CUDA-MEME: Accelerating Motif Discovery in Biological Sequences Using CUDA-enabled Graphics Processing Units", *Pattern Recognition Letters*, 31(14), 2170 - 2177, 2010  
(IF= 1.303)
13. P. Mundra and J. C. Rajapakse, "Gene and Sample Selection for Cancer Classification with Support Vectors based t-statistic", *Neurocomputing*, 73(13-15), 2353-2362,2010.(IF= 1.440)
14. P. Mundra and J.C. Rajapakse, "SVM-RFE with MRMR Filter for Gene Selection", *IEEE Transactions on NanoBioscience*, 9(1), 31-37,2010.  
(IF= 1.705)
15. Q. Liu and J.Li "Protein binding hot spots and the residue-residue pairing preference: a water exclusion perspective", *BMC Bioinformatics*, 11:244, 2010  
(IF= 3.428)
16. Li, Z. and Li, J., Geometrically centered region: A "wet" model of protein binding hot spots not excluding water molecules, *Proteins: Structure, Function, and Bioinformatics*,78: 3304–3316,2010 (IF= 3.085)
17. S.D. Handoko, C.K. Kwoh, and Y.S. Ong, "Feasibility Structure Modeling: An Effective Chaperon for Constrained Memetic Algorithms," *IEEE Transactions on Evolutionary Computing*, 14(5), pp. 740-758, 2010.
18. W. M Chiew, F. Lin, K. Qian and H.S. Seah, "Online Volume Rendering of Incrementally Accumulated LSCEM Images for Superficial Oral Cancer Detection", *World Journal of Clinical Oncology*, in press, 2010
19. J. Wang, F. Lin, "Progress of Two-Photon Laser Scanning Fluorescence Microendoscope Based on Optical Fiber", *Laser & Optoelectronics Progress*, Vol. 47, No.8, 2010, pp81701
20. H. Xu, C-L Wei, F Lin and W-K Sung, "An HMM approach to genome-wide identification of differential histone modification sites from ChIP-seq data", *Bioinformatics*, 26(9), 2010, pp1199-1204 (IF= 4.926)
21. F. Zhao, F Lin, H S Seah, "Binary SIPPER Plankton Image Classification Using Random Subspace", *Neurocomputing*, 73(10-12), 2010, pp1853-1860(IF= 1.440)
22. K. Qian, W. Haixia, G. Wenjing, F. Lin, H. S. Seah, Phase Extraction from Arbitrary Phase-shifted Fringe Patterns with Noise Suppression, *Optics and Lasers in Engineering*, Vol. 48, No. 6, 2010, pp684-689(IF= 1.2629)
23. M. Olfatnia, V.R. Singh, T. Xu, J. Miao, and L.S. Ong, "Analysis of Vibration Modes of Piezoelectric Circular Microdiaphragms", *Journal of Micromechanics and Microengineering*, Vol. 20, Number 8, 085013, 2010. (IF= 1.997)
24. B. Jayaraman, V.R. Singh, A. Asundi, G.M. Hegde and N. Bhat, "Thermo-mechanical Characterization of Surface-micromachined Microheaters using In-line Digital Holography", *Measurement Science and Technology*, Vol. 21(1), 015301, 2010.  
(IF= 1.317)
25. Q. He, K. Chang, E.-P. Lim, A. Banerjee "Keep It Simple with Time: A Reexamination of Probabilistic Topic Detection Models", *IEEE Transactions on Pattern Analysis and Machine Intelligence (IEEE TPAMI)*, vol. 32, no. 10, pp. 1781-1794,2010
26. L. Au, J. Zhou, P. Palmes, Y.-Y. Sitoh, L. C. S. Tan, and J. C. Rajapakse, "Levodopa and the feedback process on set-shifting in Parkinson's disease," *Human Brain Mapping* (in press)  
(IF= 6.256)
27. S. Xu, D. C.S. Tai, P. T.C. So, H. Yu, and J. C. Rajapakse, "An Automated Scoring System for Liver Fibrosis Diagnosis with Second Harmonic Generation Microscopy," *Australian Journal of Intelligent Information Systems* (in press)

28. H. Q. Sun, M. Y. H. Low, W. J. Hsu, J. C. Rajapakse, "RecMotif: A Novel Fast Algorithm for Weak Motif Discovery," *BMC Bioinformatics* (in press) (IF= 3.43)
29. A. M. Raja, S. Xu, W. Sun, J. Zhou, D.C.S Tai, C.S. Chen, J. C. Rajapakse, P. T.C. So, and H. Yu, Pulse Modulated Second Harmonic Imaging Microscope (PM-SHIM) imaging quantitatively demonstrates marked increase of collagen in tumor after chemotherapy, *Journal of Biomedical Optics*, 15 (5), 2010 (IF= 2.501)
30. Y. He, C. H. Kang, S. Xu, X. Tuo, S. Trasti, D. C.S. Tai, A. M. Raja, Q. Peng, P. T. C. So, J. C. Rajapakse, R. Welsch, H. Yu, "Towards Surface Quantification of Liver Fibrosis Progression", *Journal of Biomedical Optics* (in press) (IF= 2.501)
31. M. N. Nguyen, J. M. Zurada, and J. C. Rajapakse, "Towards better understanding of protein secondary structure: extracting prediction rules," *IEEE Transactions on Computational Biology and Bioinformatics* (published on line)
32. A. Ng, J. C. Rajapakse, R. E. Welsch, P. Matsudaira, and J. Evans, "Cell profiling framework for modeling drug responses from HCS imaging," *Journal of Biomolecular Screening*, Vol. 15, issue 7, 2010, pp. 858-868(IF= 2.395)
33. I. Chaturvedi and J. C. Rajapakse, "Building gene networks with time-delayed regulations," *Pattern Recognition Letters*, 31, 2010, pp. 2133-2137 (IF= 1.303)
34. Wu M, Li X, Chua HN, Kwoh CK, Ng SK, "Integrating diverse biological and computational sources for reliable protein-protein interactions", *BMC Bioinformatics*, vol. 11, p. S8 (IF= 3.43)
35. Li X, Wu M, Kwoh CK, Ng SK, "Computational approaches for detecting protein complexes from protein interaction networks: a survey", *BMC Genomics*, 11(Suppl 1): S3 (IF= 3.759)

#### **4.3 Edited Books**

#### **4.4 Book chapters**

1. D. Rebholz-Schuhmann and J-j Kim. "Automatic text analysis for bioinformatics knowledge discovery in "Knowledge-Based Bioinformatics: From Analysis to Interpretation" edited by Gil Alterovitz and Marco Ramoni, pp. 137-168, John Wiley & Sons, 2010.
2. L. Ligowski, W. Rudnicki, Y. Liu and B. Schmidt "Accurate scanning of sequence databases with the Smith-Waterman algorithm", *CUDA Gems*, to appear
3. M. Giraud, B. Schmidt, S. Janot, J.S. Varre "Many-core high-performance computing in Bioinformatics", in *Genome-scale Pattern Analysis in the Post-ENCODE Era*, to appear
4. H. Xu and F. Lin, "Computational Analysis of ChIP-seq Data and Its Application to Embryonic Stem Cells", a chapter in *Computational Biology of Embryonic Stem Cells*, Bentham Science Publishers, in press, 2010
5. F. Zhao, L.S. Cheong, F. Lin, K. Qian, H. S. Seah and S.-Y. Kung, "Registration of In Vivo Fluorescence Endomicroscopy Images Based on Feature Detection", Chapter 59 in *Advances in Computational Biology* (H.R. Arabnia Ed.), Springer, ISBN 978-1-4419-5912-6, Springer Science&Business Media, LLC 2010, September 2010

6. F. Lin and M. Stepanova, "Reconfigurable Neural System and Its Application to Dimeric Protein Binding Site Identification", Chapter 13 in *Bioinformatics: High Performance Parallel Computer Architectures*, Taylor & Francis / CRC Press, ISBN 9781439814888, July 2010
7. E.-P. Lim, A. Sun, A. Datta and K. Chang, "Information Integration for Graph Databases" in *Link Mining: Models, Algorithms, and Applications*, 2010
8. Y. Wang and J. C. Rajapakse, "Discriminative Framework of Neural Activation Analysis with fMRI," *Advanced Topics in Biometrics*, H. Li, K.-A. Toh, and L. Li (Eds.), World Scientific Publishing Co. Pte Ltd (in press)

#### 4.5 Refereed Conference Papers

1. J. C. Patra, K. H. K. Chua, "Neural Network Based Drug Design for Diabetes Mellitus Using QSAR with 2D and 3D Descriptors", *IEEE Intl. Joint Conf. Neural networks, (IJCNN 2010)*, Barcelona, Spain, July 2010, pp. 2947-2954.
2. J. C. Patra, J. Abraham, P. K. Meher and G. Chakraborty, "A Novel SOM-based Visualization Technique for DNA Microarray Data Analysis," *IEEE Intl. Joint Conf. Neural networks, (IJCNN 2010)*, Barcelona, Spain, July 2010, pp. 800-806.
3. J. C. Patra, N. V. George and P.K. Meher, "DNA Microarray Analysis Using Equalized Orthogonal Mapping", *IEEE Intl. Joint Conf. Neural Networks, (IJCNN 2010)*, Barcelona, Spain, July 2010, pp. 1657-1664.
4. H. Yu, S. S. Bhowmick, C. F. Dewey, Jr, L. Tucker-Kellogg and L. Venkatraman "The Steady States and Dynamics of Urokinase Mediated Plasmin Activation", In the Proceedings of the 15th Pacific Symposium of Biocomputing (PSB 2010), Hawaii, USA, Jan 2010.
5. J. Cheng, M. Veronika, and J.C. Rajapakse, "Identifying Cells in Histopathological Images", *Proceedings of Contests in ICPR 2010, LNCS 6388*, pp. 244–252, 2010.
6. Z. Zheng, G. Bourque, B. Schmidt, "Prediction of Low Coverage Prone Regions for Illumina Sequencing Projects using a Support Vector Machine", *IEEE International Conference on Bioinformatics & Biomedicine (IEEE BIBM 2010)*, Hong Kong, IEEE Press.
7. H. Shi, B. Schmidt, W. Liu, W. Mueller-Wittig, "Quality-Score Guided Error Correction for Short-Read Sequencing Data using CUDA", *The International Conference on Computational Science 2010 (ICCS 2010)*, Amsterdam, Netherlands, *Procedia* Vol. 1, No. 1, pp. 1123-1132, 2010
8. P. Mundra and J.C Rajapakse, "Support Vectors based Correlation Coefficient for gene and sample selection in cancer classification", *IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology*, 88-94, 2010
9. J. Li, Q. Liu, and T. Zeng. "Negative correlations in collaboration: concepts and algorithms", *Proceedings of the 16th ACM SIGKDD international conference on Knowledge discovery and data mining (KDD '10)*. ACM, New York, NY, USA, 463-472.
10. W. M. Chiew, F. Lin, K Qian, S. T. Stephanus, H. S. Seah, "Reconfigurable Logic for Synchronization of Endomicroscopy Scanning and Incrementally Accumulated Volume Rendering", *International Conference on Real-Time and Embedded Systems (RTES'10)*, Singapore, November 1-2, 2010
11. A. Jean, F. Lin, J. C. Tong, "Nested Similarity Searching for Elucidation of Evolutionarily Distant Sequences", *IEEE Workshop on Signal Processing Systems (SiPS'10)*, San Francisco Bay Area, California, USA, October 6-8, 2010

12. S. Rastogi, F. Lin, M. Chavez, "ECG Monitoring and Visual Analytics", Computer Graphics International Conference 2010 (CGI'10), Singapore, 8-11 June, 2010
13. A. Jean, F. Lin, J. C. Tong, "Nested Similarity Searching for Evolutionarily Studies", 3rd Asian Young Researchers Conference on Computational and Omics Biology (AYRCOB'10), Taiwan, 10-12 March, 2010
14. V.R. Singh, J.C. Rajakapse, H. Yu, and P.T.C. So, "Intensity normalization of two-photon microscopy images for liver fibrosis analysis", *Proc. SPIE*, to be presented in Photonics west, San Francisco, 2011.
15. V.R. Singh, S. Lui, and A. Asundi, "Digital reflection holography based systems for MEMS measurements", *Proc. SPIE*, Vol. 7718, pp. 77180Z, 2010.
16. K. Dev, V.R. Singh, A. Asundi, "Full-field TN-LCSLM phase modulation characterization using digital holography", *Proc. SPIE*, Vol. 7775, pp. 777519, 2010.
17. Z. Peilin and C.H. Steven Hoi, "OTL: A Framework of Online Transfer Learning" , The 27th International Conference on Machine Learning (ICML 2010), Haifa, Israel, 21-24 June, 2010 (Oral, acceptance rate: 152/594=25.6%)
18. J-j Kim, D Rebholz-Schuhmann, "Improving the extraction of complex regulatory events from scientific text by using ontology-based inference", Fourth International Symposium on Semantic Mining in Biomedicine (SMBM), 2010.
19. J-j Kim, V. Lee, D. Rebholz-Schuhmann. "Semantic representation of Gene Ontology terms by using Gene Regulation Ontology". Proceedings of BioOntologies 2010: Semantic applications in life sciences, pp. 148-151, 2010.
20. Z. Hai, K. Chang, Q. Song, J-j Kim. "A Statistical NLP Approach for Feature and Sentiment Identification from Chinese Reviews", CIPS-SIGHAN Joint Conference on Chinese Language Processing (CLP2010), pp. 105-112, 2010.
21. Li, Z. and Li, J., "Identifying protein binding hot spots by using deeply buried atomic contacts", In Proceeding of International Conference on Computational Systems, 155-167, 2010.
22. Yang Zhou, Rong Jin, Steven C.H. Hoi, "Exclusive Lasso for Multi-task Feature Selection", Journal Machine Learning Research, W &CP 9, vol. 9. (AISTATS 2010), Italy, May 2010
23. G. Li, S.C.H. Hoi, K.Chang, "Two-view Transductive Support Vector Machines" pp. 235-244, SDM (SIAM conference on Data Mining)", Columbus, U.S.A.
24. K. Chang, I. W. T. Perdana, B. Ramadhana, K. Sethuraman, T.V. Le, and N. Chachra "Knowledge File System – A principled approach to personal information management", IEEE SDM (Services for Data Mining), ICDM Workshop, Sydney, Australia.
25. G. Li, S.C.H. Hoi and K. Chang, "Micro-blogging Sentiment Detection by Collaborative Online Learning" IEEE ICDM (International Conference on Data Mining), Sydney, Australia.
26. Z. Hai, K. Chang, Q. Song and J.-J. Kim "A Statistical NLP Approach for Feature and Sentiment Identification from Chinese Reviews", pp. 105-112, CIPS-SIGHAN CLP (First Joint Conference on Chinese Language Processing), Beijing, China.
27. K. Ma, S.C. Hui and K.Chang "Feature Extraction and Clustering-based Retrieval for Mathematical Formulas", SEDM (2nd International Conference on Software Engineering and Data Mining), pp. Chengdu, China
28. E.-P. Lim, A.T. Kwee, N.L. Ibrahim, A. Sun, A. Datta, K. Chang and Maureen, "Visualizing and Exploring Evolving Information Networks in Wikipedia", ICADL (Asia-Pacific Digital Libraries), pp. 50-60, Gold Coast, Australia
29. Y. Zhang, A. Sun, A.Datta, K. Chang and E.-P. Lim, "Do Wikipedians Follow Domain Experts? A Domain-specific Study on Wikipedia Contribution", JCDL (ACM/IEEE Joint Conference on Digital Libraries), pp. 119-128, Gold Coast, Australia



30. G. Li, S.C.H. Hoi and K. Chang, "Two-view Transductive Support Vector Machines", SDM (SIAM conference on Data Mining), pp. 235-244, Columbus, U.S.A.
31. S. Zhu, P. Matsudaira, R. E. Welsch, and J. C. Rajapakse, "Quantification of cytoskeletal protein co-localization from high content images" Proceedings of 5th IAPR International Conference on Pattern Recognition in Bioinformatics (PRIB 2010), Nijmegen, The Netherlands, Lecture Notes in Computer Science including Lecture Notes in Bioinformatics, LNBI 6282, 2010, pp. 289 - 300
32. J. C. Rajapakse and I. Chaturvedi, "Gene regulatory networks with variable-order dynamic Bayesian networks," International Joint Conference on Neural Networks (IJCNN 2010), Barcelona, Spain
33. J. C. Rajapakse and W. Chen, "Complex ICA-R," International Joint Conference on Neural Networks (IJCNN 2010), Barcelona, Spain
34. K. S. Sri, J. M. Zurada, and J. C. Rajapakse, "Evolutionary approach to ICA-R," International Joint Conference on Neural Networks (IJCNN 2010), Barcelona, Spain

## 5 Statistics 2010

|                                |                 |
|--------------------------------|-----------------|
| Number of core faculty         | 8               |
| Number of researchers          | 11              |
| Number of Ph.D. students       | 26              |
| Number of Ph.D. completed      | 2               |
|                                |                 |
| Total active grants            | 16              |
| Total Funding                  | S\$5,541,054.69 |
| Funding per core faculty       | S\$692,631.84   |
|                                |                 |
| Number of journal papers       | 32              |
| Number of conference papers    | 34              |
| Number of books                | 1               |
| Number of books chapters       | 8               |
|                                |                 |
| Total impact factor            | 82.99           |
| Impact factor per paper        | 2.37            |
| Impact factor per core faculty | 10.37           |

## 6 Collaborators

| Faculty Name     | Partners organization and Collaborator  | Description of the Project  | Funding   |
|------------------|---|---|---|
| Lin Feng         | Dept of Diagnostic Radiology, TTSH  | Joint proposal for multi-modal imaging and informatics, use the PACS & RIS system at TTSH   |   |
| Bertil Schmidt   | Scott Rice (NTU/UNSW)   | Large-Scale Metagenomics  |   |
| Jung-jae Kim     | Jagath C Rajapakse (SCE)<br>Chang Kuiyu (SCE)<br>Lihui Chen (EEE)   | Hypothesis evaluation against biomedical literature by using concept networks   |   |
|                  | Jagath C Rajapakse (SCE)  | Constructing brain ontology for knowledge integration (Brain Sciences Initiative)   |   |
| Kwoh Chee Keong  | Dr Li Xiaoli (I2R)  | Protein-protein interactions: Core-Attachment based Mining for Protein Complexes & Small-molecule Interactions<br>Graph-Based mining; bipartite graph mining.       |   |
|                  | Dr Li Yang Hsu, NUH<br>Dr Koh Tse Hsien, SGH  | Genomic assembly and analysis a new multilocus variable-number tandem-repeat analysis scheme for molecular epidemiological typing of <i>Acinetobacter baumannii</i> | NMRC grant  |
| Jagath Rajapakse | Prof Roy Welsch (Sloan School, MIT), Prof Peter So (Department of Biological Engineering, MIT), Prof Paul Matsudaira (Department of Biological Sciences, NUS) | Mining cells from high content images for tissue systems biology  | Singapore-MIT Alliance                            |
|                  | A/Prof Vincent Chow (Department of Microbiology, NUS), Prof Jianzhu Chen (Department of Biology, MIT)   | Molecular basis of lung damage-repair under influenza virus infection   | Singapore-MIT Alliance, SMART (ID IRG), Singapore |
|                  | Prof Henry Yu (Department of Physiology, NUS), Prof Peter So  | Image informatics for liver fibrosis  | Singapore-MIT Alliance                            |