School of Computer Engineering

BioInformatics Research Centre (BIRC)

ANNUAL REPORT 2009

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Contents

1. Introduction 1
1.1 Mission and Vision 1
1.2 Research Interests 1
2 Members 2
2.1 Core faculty 2
2.2 Affiliated faculty 2
2.3 Researchers 2
2.4 Graduate Students 3
2.5 Ph.D. Awarded 5
2.6 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
3.2 Talks 5
3.3 Editorial activities 6
3.4 Conference activities 6
3.5 Symposiums and Workshops organized 6
3.6 Grants 7
4 Publications 8
4.1 Books 8
4.2 Journal Papers 8
4.3 Edited Books 10
4.4 Book chapters 10
4.5 Refereed Conference Papers 10
4.6 Conference Short Papers, Abstracts, and Posters 12
5 Statistics 2009 13
6 Collaborators 14
7 Patents 15

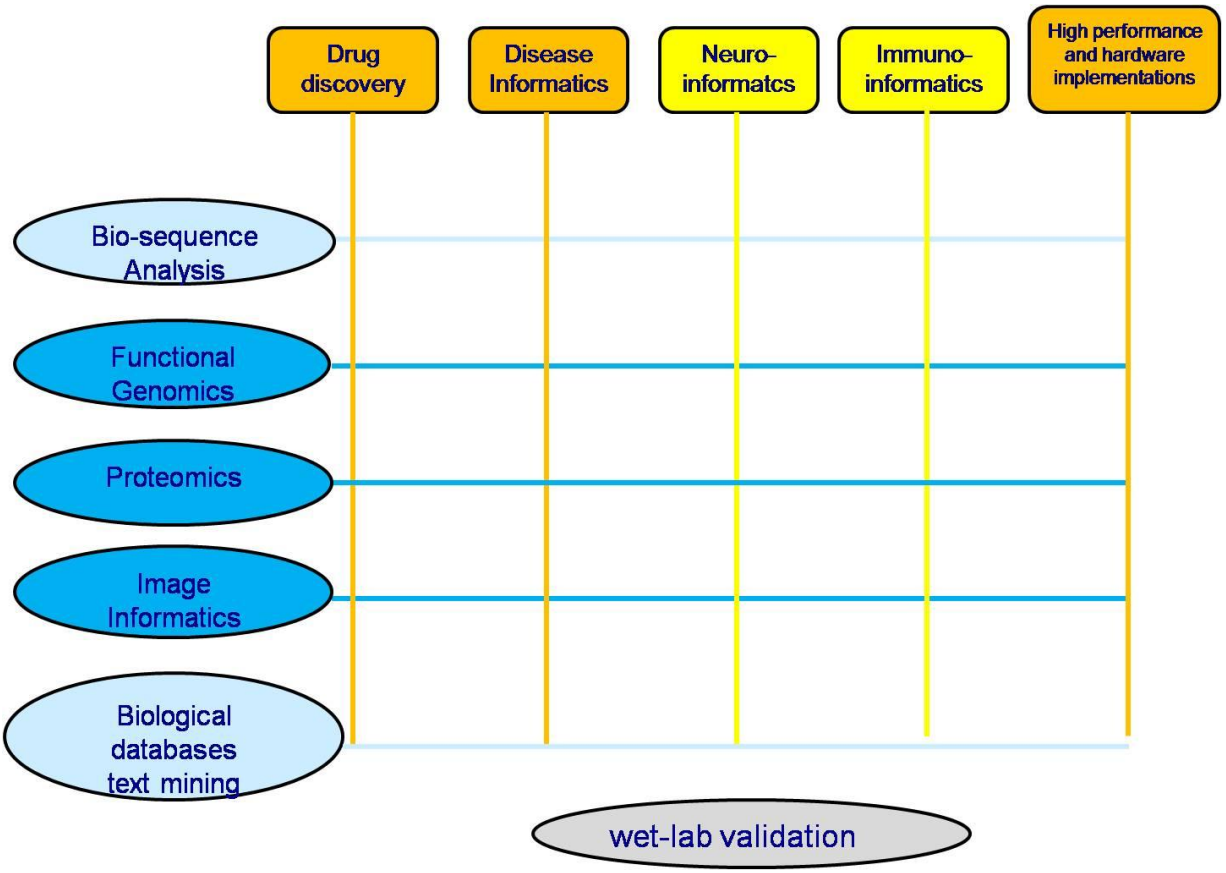
1. Introduction

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 Core faculty

Assoc Prof Sourav S. Bhowmick	SCE
Asst Prof Manoranjan Dash	SCE
Assoc Prof Kwoh Chee Keong	SCE
Asst Prof Jagdish C. Patra	SCE
Assoc Prof Li Jinyan	SCE
Assoc Prof Lin Feng	SCE
Prof Jagath C. Rajapakse	SCE
Assoc Prof Bertil Schmidt	SCE

2.2 Affiliated faculty

Assoc Prof Lay Kee Ang, Ricky	EEE
Asst Prof Vivekananda Gopalakrishnan	SCE
Adj Assoc Prof Kolatkar Prasanna Ratnakar	GIS/SCE
Adj Assoc Prof Vladimir Kuznetsov	BII/SCE
Adj Assoc Prof Li Xiaoli	I2R/SCE
Adj Assoc Prof Liu Jianjun	GIS/SCE
Assist Prof Mu Yuguan	SBS
Adj Assoc Prof Ng See Kiong	I2R/SCE
Assist Prof Su Haibin	MAE
Adj Prof Roy Welsch	MIT/SCE

2.3 Researchers

Name	Title	Project title	Supervisor	School	Duration
Mr. Perumal Anadagopu	Research Associate	Contribution of hydrophobic residues in stability on Genome, transcriptome and proteome	Li Jinyan	SCE	2009/07/09 –
Dr. Chen Peng	Research Fellow	Protein binding and interaction	Li Jinyan	SCE	2009/04/09 –
Ms. Divya Jain	Research Associate	Validation of delays in gene regulatory material	Jagath C. Rajapakse	SCE	2009/09/14 –
Dr. Cheng Jierong	Research Fellow	Data Mining & Microscopic Image Analysis	Jagath C. Rajapakse	SCE/ SMA	2007/07/15 –

Mr. Zeng Tao	Research Associate		Li Jinyan	SCE	2008/07/14 – 2009/12/01
Mr. Wu Lin	Project Officer	First principle and multi-scale modeling of high current stable electron emission from carbon nanotube	Ang Lay Kee	EEE	

2.4 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 –
Kavuri Swathi	Ph.D.	Evolutionary Approaches to ICA-R and application to Brain Signal Processing	Jagath C Rajapakse	SCE	2007/01 –
Cheong Lee Sing	Ph.D. (Part-time)	Structural Analysis of Genomic Sequences Using Digital Signal Processing Technology	Lin Feng	SCE	2006/01 –
Alvin Ng	Ph.D.	Analysis of drug treated morphological responses from HCS imaging	Jagath C Rajapakse	SCE/ SMA	2006/08 –
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 –
Mundra Piyushkumar	Ph.D.	Feature Selection for Classification of Gene Expression Data	Jagath C Rajapakse	SCE	2007/01 –
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	Li Jinyan	SCE	2007/12 –
Zhao Liang	Ph.D.	B-Cell epitope prediction	Li Jinyan	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)		Jagath C Rajapakse	SCE	2005/ 02 –
Lakhsmi 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
William Chandra	Ph.D.	First Principle Simulation on GOX BD	Ang Lay Kee, Ricky	EEE	2005/04 –
Wu Lin	Ph.D. (Part-time)		Ang Lay Kee, Ricky	EEE	2005
Zhu Xi	Ph.D.	First Principle Study of New Materials	Su Haibin	MSE	2006
Wang Jinghao	Ph.D.		Su Haibin	MSE	2008/09 –
Matus Dubecky	Ph.D.	Atomic Scale Study if Mechanisms in Organic PV	Su Haibin	MSE	2008/08 –
Zhou Feng	Ph.D.	Density Functional Theory Study on Electronic and magnetism Properties of Nanowires	Su Haibin	MSE	2008/08 –
Yang Jing	Ph.D.	Oxidation of Methanol: Application to Direct Methanol Fuel Cells	Su Haibin	MSE	2008/08 –
Yang Feng	Ph.D.	Pattern Classification of Very High Dimensional Data	Mao Kezhi	EEE	2008/06 –
Li Xiang	Ph.D.	Reliability study of advanced CMOS gate dielectrics using TEM/EELS	Pey Kin Leong	EEE	2005/07 –
Koh Wee Sing	Ph.D.		Ang Lay Kee	EEE	2005/08 –
Zhou Deyy	Ph.D.		He Yulan	SCE	2005/07 –
Pang Chee Hwa	Ph.D.		Ang Lay Kee	EEE	2006/07

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Lee Seow Eng	Ph.D.		Jagath C Rajapakse	SCE	
Li Zhenhua	Ph.D.	Protein-protein interaction and protein binding hot spots	Li Jinyan	SCE	2009/01 –
Lei Lin	Ph.D.	The usage of biomedical ontology for text mining	Jung-Jae Kim	SCE	2009/01 –
Chen Xiuying	Ph.D.		Su Haibin	MSE	2009

2.5 Ph.D. Awarded

Name	Thesis Title	Supervisor	School	Graduation Date
Menaka Rajapakse		Lin Feng	SCE	
Maria Stephanova		Lin Feng	SCE	

2.6 Master's Degrees Awarded

Nil

3 Outcomes

3.1 Awards and Honours

3.1.1 Awards and Honours (Faculty)

- *Best Paper Award,* Y. Liu, Bertil Schmidt, D. L. Maskell, "MSA-CUDA: Multiple sequence alignment on graphics processing units with CUDA," 20th IEEE International Conference on Application Specific Systems and Architectures, Boston, 2009
- *Best Paper Award,* M. Tan, Y.C. Zhou, P. Cui, W. Wang, Jinyan Li, H. Zhang, Y. Hou, and B. Yan, "Discovery of migration habitats and routes of wild bird species by clustering and association rules," ADMA 2009, China

3.1.2 Awards and Honours (Students)

- *Travel Award,* European Workshops on Evolutionary Computations (EvoStar 09), April 2009, Tuebingen, Germany. (Mr. Piyush Mundra)

3.2 Talks

- *Invited Talk:* High performance computing with heterogeneous co-processors, World Congress on Science, Engineering, and Technology, Singapore(Lin Feng)
- *Keynote:* Challenges in Microarray Data Analysis, International Conference on Bioinformatics, , Singapore (Jagath C. Rajapakse)

- *Plenary Talk:* Pattern Recognition in Bioinformatics, SLIIT Annual Research Symposium, 2009, Sri Lanka (Jagath C. Rajapakse)
- *Tutorial:* Computational Techniques for Motif Detection, Fourth IAPR International Conference on Pattern Recognition in Bioinformatics (PRIB 2009), Sept 2009, Sheffield, UK (Jagath C. Rajapakse)

3.3 Editorial activities

- *Editorial Board*, International Journal of Data Mining and Bioinformatics (Jinyan Li)
- *Editorial Board*, International Journal of Computational Sciences (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*, Journal of VLSI Signal Processing (Lin Feng)
- *Associate Editor*, IEEE/ACM *Transactions on* Computational Biology and Bioinformatics (Jagath C. Rajapakse)
- *Associate Editor*, IEEE Tran*sactions on Medi*cal Imaging(Jagath C. Rajapakse)
- *Associate Editor, IEEE Trans*actions on Neural Networks (Jagath C. Rajapakse)

3.4 Conference activities

- *Steering Committee Chair*, International Conference on Pattern Recognition in Bioinformatics (PRIB) (Jagath C. Rajapakse)
- *General Co-Chair*, Fourth International Conference on Pattern Recognition in Bioinformatics (PRIB 2009), Sept 2009, Sheffield, UK (Jagath C. Rajapakse)
- *Steering Committee*, European Workshop on Evolutionary Computations and Machine Learning in Biology (EvoBIO) (Jagath C. Rajapakse)
- *Steering Committee*, IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB) (Jagath C. Rajapakse)

3.5 Symposiums and Workshops organized

- *Workshop*, SCE-BII Workshop on Bioinformatics and Computational Biology,28/09/2009
- *Workshop*, 3rd Virtual Training Workshop on BioInformatics, 25/03/2009 – 25/05/2009
- *Seminar,* Aspects of inference from transcription (Prof. Mahesan Niranjan),5 /08 2009

3.6 Grants

Project Title	Funding Agency	Grant Amount (S$)	Partner Organization and Collaborators	NTU PI(s)	Start and end dates
Grid-Based Comparative Genomics	MOE Tier-1	$140,000.00	GIS	Jagath Rajapakse	12/2005 – 09/2009
Quasi-bipartite Graphs for Modelling Protein Binding Sites and Their Functional Homogeneity Study	MOE Tier-1	$130,000	HUST, SCUT	Li Jinyan	03/2008 – 03/2011
The Protein Binding Hot Spots Are Water Free?	MOE Tier-2	$730,020 (include 2 RSS awards)	HUST, SCUT	Li Jinyan	12/2008 – 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, SGH, GIS	Kwoh Chee Keong	05/2009 – 05/2012
Structual Anaylsis and Characterisation of Protein Complexes	Jardine OneSolution, IBM and Novaglobal	$14,018.69	IBM	Kwoh Chee Keong	05/2009 – 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 –
Advanced Image Informatics	Singapore-MIT Alliance	$850,000 (includes 2 RSS awards)	MIT, NUS	Sourav Bhowmick	07/2002 –
Development of scalable algorithms and tools for emerging sequencing technologies	MOE Tier-2	$150,000		Bertil Schmidt	05/2009 – 05/2012
GPU-enable genomics	NVIDIA Inc.	$25,000	NVIDIA	Bertil Schmidt	10/2008 – 09/2010

4 Publications

4.1 Books

1. B. Schmidt: Bioinformatics: High Performance Parallel Computer Architectures, Taylor & Francis/CRC Press, to appear

4.2 Journal Papers

1. Q. Liu. and J. Li, "Propensity vectors of low-ASA residue pairs in the distinction of protein interactions," *Proteins: Structure, Function, and Bioinformatics*, vol. 78, pp. 589-602, 2009. (IF = 3.419)
2. M. Feng, G. Dong, J. Li, Y.P. Tan, L. Wong, "Pattern Space Maintenance for Data Updates and Interactive Mining". Accepted by *Computational Intelligence*, 2009. (IF = 3.310)
3. K. Sim, J. Li, V.Goplalkrishnan, and G.Liu, "Mining maximal quasi-bicliques: Novel algorithm and applications in the stock market and protein networks," *Statistical Analysis and Data Mining*, vol. 2, pp. 255-273, 2009. (IF =)
4. J. Li and Q. Liu, "'Double water exclusion': a hypothesis refining the O-ring theory for the hot spots at protein interfaces," *Bioinformatics*, vol. 25, pp. 743-750, 2009. (IF = 4.328)
5. X. Zeng, J. Pei, K. Wang, and J. Li, "PADS: a simple yet effective pattern-aware dynamic search method for fast maximal frequent pattern mining," *Knowledge and Information Systems*, vol. 20, pp. 375-391, 2009. (IF = 1.733)
6. X. Liu, J. Li, and L. Wang, "Modeling Protein Interacting Groups by Quasi-bicliques: Complexity, Algorithm and Application," *IEEE/ACM Transactions Computational Biology and Bioinformatics* on, vol. PP, pp. 1-1, 2009. (IF =)
7. J.C. Patra and O. Singh, "Artificial neural networks-based approach to design ARIs using QSAR for diabetes mellitus", *Journal of Computational Chemistry*, vol. 30, pp. 2494-2508, 2009. (IF = 3.390)
8. G. Wenjing, K. Qian, W. Haixia, F. Lin, and S.S. Hock, "Parallel computing for fringe pattern processing: A multicore CPU approach in MATLAB® environment," *Optics and Lasers in Engineering*, vol. 47, pp. 1286-1292, 2009. (IF = 1.103)
9. M. Rajapakse, and F. Lin, "Prediction and Characterization of MHC-Peptide Binding Sites," *IEEE Engineering in Medicine and Biology Magazine*, Vol. 28, No. 4, pp 73-77, July-Aug. 2009. (IF = 1.466)
10. H. Wang, Q. Kemao, W. Gao, F. Lin, and H.S. Seah, "Fringe pattern denoising using coherence-enhancing diffusion," *Optics Letters*, vol. 34, pp. 1141-1143, 2009. (IF = 3.772)
11. L. Cheong, F. Lin, H.S. Seah, K. Qian, F. Zhao, P. Thong, K. Soo, M. Olivo, and S.Y. Kung, "Embedded Computing for Fluorescence Confocal Endomicroscopy Imaging," *Journal of Signal Processing Systems*, vol. 55, pp. 217-228, 2009. (IF = 0.779)
12. W.H. Lee, V. Narang, H. Xu, F. Lin, K.C. Chin, and W.K. Sung, "DREAM2 Challenge: Integrated Multi-Array Supervised Learning Algorithm for BCL6 Transcriptional Targets Prediction," *Annals of the New York Academy of Sciences*, vol. 1158, pp. 196-204, 2009. (IF = 2.303)
13. F. Lin and M. Olivo, The State-of-the-art Technologies for Medical and Biological Imaging, *Journal of Signal Processing Systems*, Vol. 54, No.1-3, 2009, pp 1-6 (IF = 0.779)

14. Y. Liu, B. Schmidt, W. Liu, and D. L. Maskell, "CUDA-MEME: Accelerating motif discovery in biological sequences using CUDA-enabled graphics processing units," *Pattern Recognition Letters*, vol. In Press, Corrected Proof (IF = 1.559)
15. J. Schroder, H. Schroder, S.J. Puglisi, R. Sinha, and B. Schmidt, "SHREC: a short-read error correction method," *Bioinformatics*, vol. 25, pp. 2157-2163, September 1, 2009. (IF = 4.328)
16. B. Schmidt, R. Sinha, B. Beresford-Smith, and S. J. Puglisi, "A fast hybrid short read fragment assembly algorithm," *Bioinformatics*, vol. 25, pp. 2279-2280, 2009. (IF = 4.328)
17. T. Oliver, B. Schmidt, Y. Jacop, D. Maskell, "High-Speed Biological Sequence Analysis with Hidden Markov Models on Reconfigurable Platforms", *IEEE Transactions on Information Technology in Biomedicine*, Vol. 13, No. 5, pp. 740-746, 2009. (IF = 1.939)
18. Y. Liu, D. Maskel, and B. Schmidt, "CUDASW++: optimizing Smith-Waterman sequence database searches for CUDA-enabled graphics processing units," *BMC Research Notes*, vol. 2, p. 73, 2009. (IF =)
19. A. Wirawan, B. Schmidt, H. Zhang, and C. K. Kwoh, "High performance protein sequence database scanning on the Cell Broadband Engine," *Scientific Programming*, vol. 17, pp. 97-111, 2009. (IF =)
20. S.D. Handoko, C. K. Kwoh, and Y. S. Ong, "Feasibility Structure Modeling: An Effective Chaperon for Constrained Memetic Algorithms," *IEEE Transactions on Evolutionary Computation*, 2009 Accepted (IF = 3.736)
21. M. Wu, X. Li, C.K. Kwoh, and S.K. Ng, "A core-attachment based method to detect protein complexes in PPI networks," *BMC Bioinformatics*, vol. 10, p. 169, 2009. (IF =3.781)
22. I. Chaturvedi and J.C. Rajapakse, "Detecting robust time-delayed regulation in Mycobacterium tuberculosis," *BMC Genomics*, vol. 10, p. S28, 2009. (IF = 3.926)
23. M. Jianmin, M.N. Nguyen, and J.C. Rajapakse, "Gene Classification Using Codon Usage and Support Vector Machines," *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, vol. 6, pp. 134-143, 2009. (IF =)
24. C. Jierong and J.C. Rajapakse, "Segmentation of Clustered Nuclei With Shape Markers and Marking Function," *IEEE Transactions on Biomedical Engineering*, vol. 56, pp. 741-748, 2009. (IF = 2.496)
25. J.C. Rajapakse, Pooja, C. Chunxi, and S.L. Ho., "Comparative genomic workflow," *IEEE Engineering in Medicine and Biology Magazine*, vol. 28, pp. 19-24, 2009. (IF = 1.466)
26. J.C. Rajapakse, "Computational techniques and pattern recognition [Introduction to the special issue]," *IEEE Engineering in Medicine and Biology Magazine*, vol. 28, pp. 16-18, 2009. (IF = 1.466)
27. M. Veronika, J. Evans, P. Matsudaira, R. Welsch, and J.C. Rajapakse, "Sub-population analysis based on temporal features of high content images," *BMC Bioinformatics*, vol. 10, p. S4, 2009. (IF = 3.781)
28. B. Zheng and J.C. Rajapakse, "Time Efficient DT-MRI Acquisition Parameters for Robust Estimation of Fiber Tracts," *Journal of Signal Processing Systems*, vol. 54, pp. 25-31, 2009. (IF = 0.779)
29. D. Manoranjan and S. Ayush, "Mining in Large Noisy Domains," *J. Data and Information Quality*, vol. 1, pp. 1-30, 2009.

4.3 Edited Books

1. F. Lin, M. Olivo, S.Y. Kung, (Eds.), Biomedical Imaging, Springer Science+Business Media, LLC, 2009, ISBN 978-1-4419-1165-0
2. Y. Zhang and J.C. Rajapakse, (Eds.) *Machine Learning in Bioinformatics*, Wiley and Sons, Inc., USA, 2009, ISBN 978-0-470-11672-3, 456 pages

4.4 Book chapters

1. F. Zhao, L. S. Cheong, F. Lin, K. Qian, H.S. Seah, S.Y. Kung, "Registration of In Vivo Fluorescence Endomicroscopy Images Based on Feature Detection", Chapter XX in Advances in Computational Biology, Springer, accepted for publication, 2009
2. F. Lin and M. Stepanova, "Reconfigurable Neural System and Its Application to Dimeric Protein Binding Site Identification", Chapter 12 in Bioinformatics: High Performance Parallel Computer Architectures, Taylor & Francis / CRC Press, accepted for publication, 2009
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. B. Schmidt, C. Chen, W. Liu, W. Mitchell: "PheGee@Home: A Grid-based Tool for Comparative Genomics", in Handbook of Research on Computational Grid Technologies for Life Science, Biomedicine and Healthcare, IGI Global, 2009 (ISBN: 978-1-60566-374-6)
5. 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)
6. J.C. Rajapakse and S.L. Ho, "Markov/neural model for eukaryotic promoter recognition," *Machine Learning in Bioinformatics,* Y. Zhang and J. C. Rajapakse (Eds.), John Wiley and Sons, 2009
7. A. Wirawan, B. Schmidt, and C. Kwoh, "Pairwise Distance Matrix Computation for Multiple Sequence Alignment on the Cell Broadband Engine," in Computational Science – ICCS 2009, 2009, pp. 954-963.

4.5 Refereed Conference Papers

1. Q. Liu, Y.P. Phoebe Chen, and J. Li, "High Functional Coherence in k-Partite Protein Cliques of Protein Interaction Networks," in BIBM Washington D.C., USA., 2009.
2. L. Zhao and J. Li, "Sequence-based B-cell epitope prediction by using associations in antibody-antigen structural complexes," in BIBM CSBW 2009. Washington D.C., USA.
3. P. Chen and J. Li, "Prediction of Protein Long-Range Contacts Using GaMC Approach with Sequence Profile Centers," in BIBM CSBW 2009. Washington D.C., USA.
4. L. Fei and J. Li, "Discovering Transcriptional Regulation by Integrating Protein-Protein Interaction, Gene Expression and Transcriptional Interaction Data," in OSB Zhangjiajie, China, September 2009, pp. 109-116.

5. M. Tang, Y. Zhou, P. Cui, W. Wang, J. Li, H. Zhang, Y. Hou, and B. Yan, "Discovery of Migration Habitats and Routes of Wild Bird Species by Clustering and Association Analysis," in ADMA Beijing, China, August 2009, pp. 288-301. *(BEST PAPER AWARD)*
6. J. Sun, J.C. Patra and Y. Li , Functional Link Artificial Neural Network-based Disease Gene Prediction, IEEE Intl. Joint Conf. Neural networks, (IJCNN 2009), Atlanta, Georgia, USA, June 2009, pp. 3003-3010.
7. Y. Li, J.C. Patra and J. Sun, A New Method to Combine Heterogeneous Data Sources for Candidate Gene Prioritization, IEEE Intl. Conf. Bioinformatics and Bioengineering (BIBE 2009), Taichung, Taiwan, June, 2009, pp.123-129.
8. M.M. Movania, L.S. Cheong, F. Zhao, F. Lin, K. Qian, H.S. Seah, "GPU-based Surface Oriented Interslice Directional Interpolation for Volume Visualization.," in The 2nd International Symposium on Applied Sciences in Biomedical and Communication Technologies (ISABEL'09), Bratislava, Slovak Republic, November 24-27, 2009
9. F. Zhao, F. Lin, K. Qian, H. S. Seah, S.Y. Kung, "Feature-Based Registration of Confocal Fluorescence Endomicroscopy Images.," in IEEE International Conference on Image Processing (ICIP'09), Cairo, Egypt, November 7-11, 2009
10. F. Zhao, F. Lin, H. S. Seah, "Bagging Based Plankton Image Classification.," 2009 IEEE International Conference on Image Processing (ICIP'09), Cairo, Egypt, November 7-11, 2009
11. J. Wang, F. Lin, K. Qian, Z. Tang, H.S. Seah, "Influence of Numerical Aperture on Focal Spot in Turbid Media Microscopy.," in The 2nd International Conference on Image and Signal Processing (CISP'09), Tianjin, China, October 17-19, 2009
12. M.M. Movania, F. Lin, K. Qian, H.S. Seah, "Automated Local Adaptive Thresholding for Real-time Feature Detection and Rendering of 3D Endomicroscopic Images on GPU.," in The 2009 International Conference on Computer Graphics and Virtual Reality (CGVR'09), Las Vegas, US, July 13-16, 2009
13. T. Hong, F. Lin, H.S. Seah, "Incorporating Structural Properties of Steroid Hormone Receptors and DNA into Statistic Model for HRE Recognition.," in The 2009 International Conference on Bioinformatics and Computational Biology (BIOCOMP'09), Las Vegas, US, July 13-16, 2009
14. S.S. Tandjung, F. Zhao, F. Lin, K. Qian, H.S. Seah, "Synchronized Volumetric Cell Image Acquisition with FPGA-Controlled Endomicroscope.," in The 2009 International Conference on Embedded Systems and Applications (ESA'09), Las Vegas, US, July 13-16, 2009
15. F. Zhao, X. Tang, F. Lin, S. Samson, and A. Remsen, "Binary Plankton Image Classification Using Pairwise Classifiers.," in The 2009 International Conference on Image Processing, Computer Vision, and Pattern Recognition (IPCV'09), Las Vegas, US, July 13-16, 2009
16. S. Menon, F. Lin, K. Qian, H.S. Seah, "A NURBS Volume Based Mass-Spring Model for Real-Time Simulation Through Its GPU Implementation.," in The 2009 International Conference on Modeling, Simulation and Visualization Methods (MSV'09), Las Vegas, US, July 13-16, 2009
17. Patricia S.P. Thong, M. Olivo, F. Lin, H.S. Seah, S.S. Tandjung, K. Qian, William W. L. Chin, Ramaswamy Bhuvaneswari, K. Mancer, K.C. Soo, "Detection and diagnosis of human oral cancer using hypericin fluorescence endoscopic imaging interfaced with embedded computing.," in International Photodynamic Association World Congress 2009, USA, June 2009
18. Y. Liu, B. Schmidt, D.L. Maskell: "*MSA-CUDA: Multiple Sequence Alignment on Graphics Processing Units with CUDA*", 20th IEEE International Conference on Application-specific Systems, Architectures and Processors (ASAP 2009), Boston, MA, IEEE Press, Boston, MA, IEEE Press, pp. 121-128, 2009 *(BEST PAPER AWARD)*

19. A. Wirawan, B. Schmidt, C.K. Kwoh: "*Pairwise Distance Matrix Computation for Multiple Sequence Alignment on the Cell Broadband Engine*", The International Conference on Computational Science 2009 (ICCS 2009), Baton Rouge, Louisiana, Springer, LNCS 5544, pp. 962-971, 2009
20. H. Shi, B. Schmidt, W. Liu, K. Mueller-Wittig: "*Accelerating Error Correction in High-Throughput Short-Read DNA Sequencing Data with CUDA*", 8th IEEE International Workshop on High Performance Computational Biology (HiCOMB 2009), Rome, Italy, IEEE Press,
21. Y. Liu, B. Schmidt, D. Maskell: "*Parallel Reconstruction of Neighbor-Joining Trees for Large Multiple Sequence Alignments using CUDA*", 8th IEEE International Workshop on High Performance Computational Biology (HiCOMB 2009), Rome, Italy, IEEE Press,
22. Y. Chen, B. Schmidt, D. Maskell: "*A Reconfigurable Bloom Filter Architecture for BLASTN*", 22nd International Conference on Architectures of Computing Systems (ARCS 2009), Delft, Netherlands, Springer, LNCS, Vol. 5455, pp. 40-49, 2009
23. C.N. Otto, S.D. Handoko, and C. K. Kwoh, "Identifying Patterns of Conformational Changes in HLA-A*0201-related Immunological Activities," in International Conference on Biomedical and Pharmaceutical Engineering (ICBPE2009) Singapore, 2009
24. A.Wirawan, B. Schmidt, and C.K. Kwoh, "Pairwise Distance Matrix Computation for Multiple Sequence Alignment on the Cell Broadband Engine," in The International Conference on Computational Science 2009 (ICCS 2009) Baton Rouge, Louisiana, USA, 2009.
25. S.D. Handoko, C.K. Kwoh, and Y.S. Ong, "Classification-assisted Memetic Algorithms for Equality-constrained Optimization Problems," in The 22nd Australasian Joint Conference on Artificial Intelligence, Australia, 2009.
26. J. Cheng, E.G.L. Koh, S. Ahmed, and J.C. Rajapakse, "Joint tracking of cell morphology and motion," In *Pattern Recognition in Bioinformatics*, PRIB 2009 Proceedings*,3* LNBI 5780, pp. 36-45
27. M.N. Nguyen, J. Ma, G.B. Fogel, and J.C. Rajapakse, "Di-codon usage for gene classification," In *Pattern Recognition in Bioinformatics*, PRIB 2009*,* LNBI 5780, pp. 211-221, 2009
28. P.A. Mundra and J.C. Rajapakse, "F-score with Pareto front analysis for multiclass gene selection," *Evolutionary Computation, Machine Learning and Data Mining in Bioinformatics*, EvoBio 2009 Proceedings, C. Pizzuti, M. D. Ritchie, M. Giacobini (Eds.), LNCS 5483, pp. 56-67, 2009

4.6 Conference Short Papers, Abstracts, and Posters

1. S.Y. Xu, H. Yu, J.C. Rajapakse, "An automated two-channel morphology-based quantification system for liver fibrosis assessment with second harmonic generation microscopy," the 10th SMA Symposium, 2009, Singapore
2. S. Zhu, P. Matsudaira, J.C. Rajapakse "Analyzing GFP-tagged Cytoskeletal Protein Colocalization in Hela Cells", 10th SMA symposium, 2009, Singapore
3. M. Veronika, J. Evans, P. Matsudaira, R. Welsch and J. C. Rajapakse (2009). Classification of Cell Morphologies Based on Kinetic Features." The 10th SMA Symposium in Singapore, Technical Parallel Session on Computation and Systems Biology
4. J. Cheng, J.C. Rajapakse and Esther G. L. Koh, "An Automatic Approach for Dendrite Detection in 3D Microscopic Images", The Singapore-MIT Alliance (SMA) 10th Anniversary Symposium, 2009

5 Statistics 2009

Number of core faculty	08
Number of researchers	06
Number of Ph.D. students	35
Number of Ph.D. graduated	02
Number of M.Sc. students	
Number of M.Sc. students graduated	
Total active grants	9
Total Funding	S$4,678,918.69
Funding per core faculty	S$584,864.84
Number of journal papers	29
Number of conference papers	28
Number of books	01
Number of books chapters	07
Total impact factor	59.967
Impact factor per paper	2.067
Impact factor per faculty	7.49

6 Collaborators

Faculty Name	Partners organization and Collaborator	Description of the Project	Funding
Assoc Prof Lin Feng	GIS		Nil
	BII		Nil
Assoc Prof Li Jinyan	Professor Qiang Yang (Hong Kong University of Science and Technology)	Transfer learning in bioinformatics problems	
	Professor Yuanqing Li (South China University of Technology)	Genomic neuroscience	
Assoc Prof Sourav Saha Bhowmick	C Forbes Dewey, Jr (MIT)		
	Hanry Yu (NUS)		-
	Lisa Kellogg (NUS)		
Prof Jagath C. 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 Hanry Yu (Department of Physiology, NUS), Prof Peter So	Image informatics for liver fibrosis	Singapore-MIT Alliance
	Dr. Simon See (Sun Microsystems, Inc.)	High performance computing for advanced image analysis	Sun Microsystems, USA

	Prof Wei Wang (Department of Computing and Information Technology, Fudan University)	Grid-enabled pipeline for detecting functionally important conserved non-coding regions from	BMRC-A*STAR, MOE
	Dr. Alexei Kochetov (Institute of Cytology and Genetics, Russian Academy of Sciences), Prof Akinori Sarai (Department of Biochemical Engineering, Kyushu Institute of Technology, Japan), A/Prof Shandar Ahmad (Jamia Millia Islamia University, New Delhi), Prof Jacek Zurada (Electrical and Computer Engineering Department, University of Louisville), Dr. Gray Fogel (Natural Selection Inc., USA)	Prediction of gene and protein features	BIRC-NTU

7 Patents