Welcome

Center for Intelligent Multidimensional Data Analysis (CIMDA)

Presentation by
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Cutting-Edge R&D Topics

AI; Big data analysis
Tensor and hypergraph theories
Machine learning; Neural nets; Co-clustering
GPU / FPGA / ASIC; Parallel computing
Hardware and software development
Signal / image / video analysis and recognition
Data analysis applications in biology and medicine
Computer graphics and animation
Multimedia systems; Digital entertainment
Example: Facial Expression Recognition

**Our contributions:**
- Online tensor learning
- Low rank representation
- Real-time face tracking
- Feature selection based on co-clustering
- Expression recognition

References:
Example: Vehicle Tracking and Identification

Example: Pattern Matching and Recognition

Our contributions:

* Tensor and hypergraph models
* Optimization based on nonmonotone spectral projected gradients
* Global convergence of solution is proven

Spectral Matching (SM)
Max-Pooling Matching (MPM)
Integer Projected Fixed Point (IPFP)
Probabilistic Graph Matching (HGM)
Tensor Matching (TM)
Reweighted Random Walk Hypergraph Matching (RRWHM)
Block Coordinate Ascent Graph Matching (BCAGM)
Alternating Direction Graph Matching (ADGM)

Collaborations:
CityU
CUHK
HKBU
HKU
PolyU


Accuracy comparison of the proposed method with existing ones on natural images

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<th>Image</th>
<th>SM</th>
<th>MPM</th>
<th>IPFP</th>
<th>HGM</th>
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Example: Sports Video Analysis and Recognition

Example: Cell Imaging and Lineage Analysis

Image from www.wormatlas.org/ver1/handbook/anatomyintro/anatomyintro.htm

Our contributions:
* Cell tracking and matching
* Cell-cell contact analysis
* Biological network inference

Collaborations:
HKBU
HKUST
Peking U
CityU

> 20 TB data

References:
VW S Ho, MK Wong, X An1, D Guan, J Shao, HCK Ng, X Ren, K He, J Liao, Y Ang, L Chen, X Huang, B Yan, Y Xia, LLH Chan, KL Chow, H Yan, and Z Zhao, Molecular Systems Biology, 11:814, 2015.
L Chen, VWS Ho, MK Wong, X Huang, LY Chan, HCK Ng, X Ren, H Yan, and Z Zhao, Genetics, 209(1):36-49, 2019.
Example: Lung Cancer Drug Resistance Analysis

Top cancer mortalities in 2018:
- Lung: 1.760 M (~18%)
- Colorectal: 0.862 M
- Stomach: 0.783 M
- Liver: 0.782 M
- Breast: 0.627 M
- All: 9.60 M

Lung Carcinoid Tumor: 5%
Small Cell Lung Cancer: 10~15%
Non-Small Cell Lung Cancer: 85%

References:
- www.cancer.org/cancer/lungcancer/
- www.who.int/mediacentre/factsheets/fs297/en/
- www.uniprot.org/uniprot/P00533
- bcc.ee.cityu.edu.hk/med/
- L Ma, D Wang, Y Huang, M Wong, V Lee, and H Yan, Computers in Biology and Medicine, 2014.

Our contributions:
- EGFR mutant modeling
- EGFR-drug complex analysis
- Prediction of anti-EGFR drug resistance
Example: FPGA based Hardware Accelerators

Our contributions:
* Hardware accelerators for Hankel tensor decomposition
* Significant reduction in storage
* Significant reduction in computational time

References:
Example: Mobile Devices for Motion Detection

Our contributions:
* Hardware design
* Motion data classification
* Small and fast
* Low-cost healthcare

Hong Kong Science & Technology Park
CIMDA Office: RA Area
Opportunities – Realize Your Dreams

Interactions with top researchers in the world
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Working on emerging technologies
Being part of ambitious and innovative R&D teams
Creating new products and services
Startups; Unicorns; IPOs ...
You imaginations; Many opportunities ...

Realizing your dreams... Sky is the limit!
R&D Positions Available

Good publication record (for postdocs)
Good programming skills (C++, Python, etc. for desktops & mobiles)
Hardware design skills (FPGA, ASIC)
Ambitious; Highly motivated; Good communication skills
Able to work under pressure

Research assistants; Programmers
Postdoctoral fellows; Engineers / Scientists / Visitors
IT professionals; Multimedia designers

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End of Presentation

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www.ee.cityu.edu.hk/~hpyan
bcc.ee.cityu.edu.hk/tensor/w_links.html

Thank you for attending the presentation