HIMA: Histopathological Image Analysis Ontology and Imaging Informatics Workshop

Metin Gurcan, PhD
Associate Professor
Department of Biomedical Informatics
HIMA Organizing Committee

Metin Gurcan, PhD, The Ohio State University
Mike Feldman, MD, PhD, University of Pennsylvania
Anant Madabhushi, PhD, Case Western Reserve University
Nasir Rajpoot, PhD, University of Warwick
John Tomaszewski, MD, University of Buffalo
TH-PM-SFS1: Computational Histopathology: Advances and New Challenges

Session Type: Special Oral
Time: Thursday, May 15, 14:00 - 16:00
Location: La Seine B

TH-PM-SFS1.1: AUTOMATED GLAND AND NUCLEI SEGMENTATION FOR GRADING OF PROSTATE AND BREAST CANCER HISTOPATHOLOGY
Shivang Naik; Rutgers University
Scott Doyle; Rutgers University
Shannon Agner; Rutgers University
Anant Madabhushi; Rutgers University
Michael Feldman; University of Pennsylvania
John Tomaszewski; University of Pennsylvania

TH-PM-SFS1.2: MULTI-MODAL IMAGING OF HISTOLOGICAL TISSUE SECTIONS
Ali Can; General Electric
Musodiq Bello; General Electric
Harvey Cline; General Electric
Xiaodong Tao; General Electric
Fiona Ginty; General Electric
Michael Gerdes; General Electric
Michael Montalto; General Electric

TH-PM-SFS1.3: COLOR AND TEXTURE BASED SEGMENTATION OF MOLECULAR PATHOLOGY IMAGES USING HSOMS
Manasi Datar; GE Global Research
Dirk Padfield; GE Global Research, Rensselaer Polytechnic Institute
Harvey Cline; GE Global Research

TH-PM-SFS1.4: PATHOLOGICAL IMAGE SEGMENTATION FOR NEUROBLASTOMA USING THE GPU
Antonio Ruiz; University of Malaga
Jun Kong; Ohio State University
Manuel Ujaldon; University of Malaga
Kim Boyer; Ohio State University
Joel Saltz; Ohio State University
Metin Gurcan; Ohio State University

TH-PM-SFS1.5: AUTOMATED LOCALIZATION AND QUANTIFICATION OF PROTEIN MULTIPLEXES VIA MULTISPECTRAL FLUORESCENCE IMAGING
HIMA 2007-2014

8/15-16/2007    Drexel University, Philadelphia, PA
5/15/2008       ISBI, Paris, France
9/6/2008        MICCAI, New York, NY
7/6-7/2009      OSU, Columbus, OH
9/20/2009       MICCAI, London, UK
8/23/2010       ICPR, Istanbul, Turkey
9/19/2010       Pathology Informatics, Boston, MA
10/4/2011       Pathology Informatics, Pittsburgh, PA
8/18/2011       MICCAI, Toronto, Canada
2/9/2012        SPIE MI, San Diego, CA
10/5/2012       MICCAI, Nice, France
10/9/2012       Pathology Informatics, Chicago, IL
2/10-11/2013    SPIE MI, Lake Bueno Vista, FL
2/15-16/2014    SPIE MI, San Diego, CA
05/13/2014      Pathology Informatics, Pittsburgh, PA
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker(s)</th>
<th>View Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:00–1:45</td>
<td>Sequential Imaging Techniques for Multimodal Microscopy Imaging and Automated Image Processing</td>
<td>Dr. Ali Can</td>
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<tr>
<td>1:45–2:15</td>
<td>Image Object Detection and Segmentation</td>
<td>Dr. Ulysses Balis</td>
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<td>2:15–3:00</td>
<td>Feature Extraction in Histopathology Images</td>
<td>Dr. Nasir Rajput</td>
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<td>3:00–3:20</td>
<td>Break</td>
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<td>3:30–4:15</td>
<td>Searching for a Few Good Features</td>
<td>Dr. Bulent Yener</td>
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<td>4:15–5:00</td>
<td>Manifold Learning and Object Classification</td>
<td>Dr. Anant Madabhushi</td>
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<td>5:00–5:50</td>
<td>Break. Light hors d’oeuvre.</td>
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<td>5:50–6:40</td>
<td>Visual Experience in Digital Pathology</td>
<td>Dr. Emily Patterson and Caroline Gill</td>
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<td>6:40–7:10</td>
<td>Cell-Based Quantification of Molecular Biomarkers in Histopathology Specimens by Spectral Imaging and Automated Analysis</td>
<td>Dr. Badri Roysam</td>
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<td>7:10–7:40</td>
<td>Computer-Assisted Histopathological Image Analysis for Whole-Slide Images</td>
<td>Dr. Melin Gürcan</td>
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<td>7:40–8:10</td>
<td>Graph-based Features for Prognosis Prediction in Digital Pathology</td>
<td>Drs. Anant Madabhushi, Michael Feldman, John Tomaszewski</td>
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<tr>
<td>8:10–8:40</td>
<td>Endoscopic Microscopy: Bridging the Radiology-Pathology Divide</td>
<td>Dr. Gary Tearney</td>
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<td>8:40–9:00</td>
<td>Discussion Panel. All faculty members.</td>
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HIMA @ PI 2011

Clinical and Preclinical Applications and Evaluation

8:15-8:45 Integrating the Digital Microscope into Clinical Practice
Stephen Hewitt

8:45-9:15 Assessment of Computer-Aided Image Analysis Devices:
Experience Gained from CAD in Radiology
Berkman Sahiner

9:15-9:45 Observer Variability in the Assessment of Tissue-Based Biomarkers
with Unaided and Computer-Aided Digital Microcopy
Marios Gavrielides

9:45-10:00 PANEL DISCUSSION (15 minutes)

10:00-10:20 Refreshment Break

Novel Imaging and Fusion Techniques

10:20-11:00 Chemical Imaging for Histopathology: An Emerging Route for
Molecular and Structural Analysis of Tissues
Michael John Walsh

11:00-11:45 Quantitative Data Fusion for Disease Diagnosis, Prognosis and
Theragnosis
Anant Madabhushi

11:45-Noon Panel discussion (15 minutes)

12:00-1:00 Luncheon Break

1:00-1:50 Quantitative Histological Imaging in Prostate Cancer (HistOCA
John Tomaszewski

1:50-2:45 Multiplexed Immunofluorescence in Formalin-Fixed Paraffin
Embedded Prostate Cancer
Jens Rittscher & Michael Gerdes

2:45-3:00 Panel discussion (15 minutes)

3:00-3:20 Refreshent break

3:20-4:00 Workshop summary and recapitulation
### HIMA @ PI 2012

**Tuesday, October 9, 2012**

**HIMA Workshop**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
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| 8:00 – 8:30 | Introduction to HIMA  
Metin Gurcan, PhD, Department of Biomedical Informatics, College of Medicine, The Ohio State University  
Title: “HIMA: Challenges, Expectations” |
| 8:30 - 10:00 | **Visual perception and Human Factors**  
da. Darren Treanor, MD—Consultant pathologist at Leeds Teaching Hospitals, Britain—title: “Leeds virtual pathology project”  
b. Elizabeth Krupinski, PhD, Professor and Vice-chair of Research at the University of Arizona in the Department of Medical Imaging—title: “Appreciating the Role of Visual Perception & Human Factors in Whole Slide Image Evaluation” |
| 10:00 - 10:30 | Break |
| 10:30 – 12:00 | **Novel pathological image analysis techniques**  
a. Andy Beck, MD, Assistant Professor of Pathology at Harvard Medical School and Director of the Molecular Epidemiology Research Laboratory at Beth Israel Deaconess Medical Center—Title: “Computational image analysis of cancer morphology to build prognostic models and biological networks”  
b. Bahram Parvin, PhD, Lawrence Berkeley National Laboratory, University of California—Title: “Molecular Basis of Tumor Heterogeneity and Morphometric subtypes in Glioblastoma Multiforme (GBM)” |
| 12:00 - 1:30 | Luncheon break |
| 1:30 – 3:00 | **Personalized Medicine in 21st Century via Digital Pathology**  
c. Walter Schubert, M.D., Molecular pattern recognition research group, OvGU—University Magdeburg, Germany; International faculty, Max Planck (CAS-MPG) partner institute for computational biology, Shanghai, China; Human toponome project, TNI, Munich, Germany—Title: “Parameter-unlimited real time stoichiometric decoding of five thousand protein cluster networks in a single diagnostic tissue section at nanometer resolution: the human toponome project”  
d. Richard Levenson, MD, Professor and Vice Chair for Strategic Technologies Department of Pathology & Laboratory Medicine University of California, Davis Medical Center—Title: “Past, present and future” |
| 3:00 – 3:30 | Refreshment break |
| 3:30 – 4:30 | Panel Discussion |
| 4:30 – 5:00 | Workshop summary and recapitulation. |
Workshop Program - 2014

Metin Gurcan, PhD Workshop Coordinator (Workshop B)
8:00-8:05 am
Introduction to HIMA methods
Metin Gurcan, PhD
8:05-9:00 am
Beyond Heterogeneity: Tackling Cancer Detection with Non-Linear Machine Learning Methods
Eric Cosatto, PhD
9:05-10:00 am
Quantitative In Situ Measurement of Biomolecules for Companion Diagnostics
David L. Rimm, MD, PhD
10:00-10:30 am
Refreshment Break
10:35-11:30 am
New In Situ and Microdissection Technologies for Molecular Pathology
Michael Tangrea, PhD
11:30-Noon
Discussion
Noon-1:30 pm
Luncheon Break – ON YOUR OWN
1:35-2:30 pm
Sex, Drugs, and Rock & Roll: a Community Pathologist's View of Digital Pathology
Eric Glassy, MD
2:30-3:00 pm
Refreshment Break
3:05-4:00 pm
Go Large! Opportunities and Challenges Presented by Whole-Mount Histopathology
Anne L. Martel, PhD
4:00-5:00 pm
Panel Discussion: Discussion at the end of the talks with all the speakers to discuss different aspects of Histopathological Image Analysis (HIMA)
9 - 14 February 2013
Disney's Coronado Springs Resort
Lake Buena Vista (Orlando Area), Florida,
United States

Digital Pathology
Quadriceps Segmentation
Meniscus Segmentation
Femur and Tibia Segmentation
Muscle Tissue Type Determination
Ground truth Marking

- Pathologists marked center of brown nucleus (blue circles)
- Manual markings were not always consistent
  - False positive manual markings (yellow circles)
  - False negative manual markings (green circles)
Detection rates: Computer versus human readings

Category of the cells according to human readers consensus
Histopathological Image Analysis: A Review

Metin N. Gurcan, Senior Member, IEEE, Laura E. Boucheron, Member, IEEE, Ali Can, Anant Madabhushi, Senior Member, IEEE, Nasir M. Rajpoot, Member, IEEE, and Bulent Yener, Senior Member, IEEE

Methodological Review
## Papers and Special Issues

<table>
<thead>
<tr>
<th>Year</th>
<th>Special Issue Details</th>
<th>Number of Papers</th>
<th>Journal Title</th>
<th>Editors</th>
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<tr>
<td>2009</td>
<td>Special Issue on Multivariate histology</td>
<td>4 papers</td>
<td>IEEE Trans on Medical Imaging</td>
<td>Editors: Gurcan, Dhawan</td>
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<tr>
<td>2012</td>
<td>Special Issue on 3rd HIMA workshop</td>
<td>12 papers</td>
<td>Journal of Pathology Informatics</td>
<td>Editors: Gurcan, Madabhushi, Rajpoot</td>
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<tr>
<td>2013</td>
<td>Special Issue on 4th HIMA workshop</td>
<td>12 papers</td>
<td>Journal of Pathology Informatics</td>
<td>Editors: Gurcan, Madabhushi, Rajpoot</td>
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HIMA - Resources

Journal

- Journal of Pathology Informatics
Research Article

Barriers and facilitators to adoption of soft copy interpretation from the user perspective: Lessons learned from filmless radiology for slideless pathology

Emily S. Patterson, Mike Rayo, Carolina Gill¹, Metin N. Gurcan²
HIMA - Resources

Keep in touch

• Email list

• [hia_group]
HIMA - Resources

Keep in touch
• Twitter: Himaweb
Interoperability

• Specialties (radiology, pathology)
• Centers
  – Data
  – Algorithms
  – Output/outcome
  – Annotations
• Query
Collaborators:

**Medical**
- Tom Best, MD, PhD
- John Byrd, MD
- Bob Castille, MD
- Dave Flanigan, MD
- Amy Gewirtz, MD
- Eric Hsi, MD, PhD
- Becky Jackson, MD
- Alex Judkins, MD
- Gerard Lozanski, MD
- Fred Long, MD
- Maryam Lutsberg, MD
- Emilia Mahoney, MD, PhD
- Enver Ozer, MD
- Pierluigi Porcu, MD
- Frederick Racke, MD, PhD
- Arwa Shana’ah, MD
- Charles Shapiro, MD
- Hiroyuki Shimada, MD, PhD
- Farzan Siddiqui, MD, PhD
- Henry Wong, MD, PhD
- John Zhao, MD, PhD

**Technical**
- Umit Catalyurek, PhD
- Ajit Chaudhari, PhD
- Enis Cetin, PhD
- Murat Dundar, PhD
- Carol Gil, PhD
- Kun Huang, PhD
- Hui Kong, PhD
- Ashok Krishnamurthy, PhD
- Maryann Martone, PhD
- Erkan Mumcuoglu, PhD
- Myriam Oger, PhD
- Laura Schmidt, PhD
- Philip Payne, PhD
- Emily Patterson, PhD
- Mike Pennell, PhD
- Kimeryl Powell, PhD
- Jeff Prescott, PhD
- Nasir Rajpoot, PhD
- Ray Raylman, PhD
- Sidhardt Samsi, MSc
- Olcay Sertel, PhD
- Bulent Yener, PhD
Ontologies