Shahira Abousamra

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EDUCATION

PhD in Computer Science, Stony Brook University, NY   **Sep 2016 – Expected May 2024**

GPA: 4.0 /4.0   *Advisors:* Dr. Chao Chen and Dr. Dimitris Samaras.

Thesis: Deep Learning with Cellular Context for Digital Pathology: A Spatial and Topological Perspective.

MSc in Computer Science and Automatic Control, University of Alexandria, Egypt   **Sep 2005 – Jan 2011**

(Part time while working full time job.)

GPA: equivalent (3.83/4.0)   *Advisors:* Dr. Ahmed H. ElMahdy, Dr. Mohamed S. Selim.

Thesis: Enhancing Cache Performance via Adaptive Set-Based Partitioning.

BSc in Computer Science and Automatic Control, University of Alexandria, Egypt   **Sep 2000 – Jun 2005**

GPA: 90.17% − equivalent (3.89/4.0)*, Grade:* Distinction with Honors, *Class Ranking:* 7th

Advisor: Dr. Khaled Nagi

Graduation Project: Building an Agent-Based Bidding System for the Electric Power Market

INDUSTRY EXPERIENCE

▪ **Applied Scientist Intern – Amazon**   **June 2022 – September 2022**

Project: Representation learning with language-vision models for radiology data.
Mentored by Erhan Bas and Gurumurthy Swaminathan.

▪ **Applied Scientist Intern – Amazon**   **June 2021 – September 2021**

Project: Clustering refinement from edge similarity features using graph neural networks.
Mentored by Changhe Yuan and Tal Neiman.

▪ **Teaching Assistant – Stony Brook University, NY**   **September 2016 – December 2018**

TA for courses CSE 592 Convex Optimization, CSE 527 Introduction to Computer Vision, CSE 114 Computer Science I - Procedural and object-oriented programming, CSE 305 Principles of Database Systems.

▪ **Technical Team Lead – Ejada, Alexandria, Egypt**   **May 2013 – June 2016**

Development team leader for a team of 5 members developing a large-scale software system for electricity reading with both web and mobile integrated systems, in addition to personally investigating performance optimizations.

▪ **Senior Software Engineer – Ejada, Alexandria, Egypt**   **June 2007 – May 2013**

Designed and implemented pilot and other analyses workflows for the poison control centers automation system.
Developed and supported ERP systems framework, and solely implement Business Rules, Payroll, and Vacations Engines.

▪ **Software Engineer – GPS Experts, Alexandria, Egypt**   **July 2006 – May 2007**

Developed most image processing algorithms, GUI, and functionalities for a GIS application for as-built road reporting and feature extraction for the department of transportation.

▪ **Software Engineer – eSpace, Alexandria, Egypt**   **August 2005 – May 2006**

Developed dynamic report generation tools and content management system customization.

SELECTED PUBLICATIONS

Topology-Guided Multi-Class Cell Context Generation for Digital Pathology.

S. Abousamra, R. Gupta, T. Kurc, D. Samaras, J. Saltz, and C. Chen. In IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**), 2023, (acceptance rate 25.78%) (Featured in CVPR Daily magazine).

Calibrating Uncertainty for Semi-Supervised Crowd Counting.

C. Li, X. Hu, S. Abousamra, and C. Chen. In IEEE/CVF International Conference on Computer Vision (**ICCV**), 2023.

Unsupervised Stain Decomposition via Inversion Regulation for Multiplex Immunohistochemistry Images.

S. Abousamra, D. Fassler, J. Yao, R. Gupta, T. Kurc, L. Escobar-Hoyos, D. Samaras, K. Shroyer, J. Saltz, and C. Chen. In Medical Imaging with Deep Learning (**MIDL**), 2023 (Oral).

Deep Learning-Based Mapping of Tumor Infiltrating Lymphocytes in Whole Slide Images of 23 Types of Cancer.

S. Abousamra, R. Gupta, L. Hou, R. Batiste, T. Zhao, A. Shankar, A. Rao, C. Chen, D. Samaras, T. Kurc, and J. Saltz. **Frontiers in Oncology**, 2022.

Multi-Class Cell Detection Using Spatial Context Representation.

S. Abousamra, D. Belinsky, J. Arnam, F. Allard, E. Yee, R. Gupta, T. Kurc, D. Samaras, J. Saltz, and C. Chen. In IEEE/CVF International Conference on Computer Vision (**ICCV**), 2021, (Oral, acceptance rate 3%).

Localization in the Crowd with Topological Constraints.

S. Abousamra, M. Hoai, D. Samaras, and C. Chen, Localization in the Crowd with Topological Constraints. In AAAI Conference in Artificial Intelligence (**AAAI**), 2021, (acceptance rate 21.4%).

Deep Learning-Based Image Analysis Methods for Brightfield-Acquired Multiplex Immunohistochemistry Images.

D. Fassler*, S. Abousamra*, R. Gupta, C. Chen, M. Zhao, D. Paredes, S. Batool, B. Knudsen, L. Escobar-Hoyos, K. Shroyer, D. Samaras, T. Kurc, and J. Saltz. In **Diagnostic Pathology**, no. 1 (2020): 1-11.

Weakly-Supervised Deep Stain Decomposition For Multiplex IHC Images

S. Abousamra, D. Fassler, L. Hou, Y. Zhang, R. Gupta, T. Kurc, L. F. Escobar-Hoyos, D. Samaras, B. Knudson, K. Shroyer, J. Saltz, and C. Chen. In IEEE International Symposium on Biomedical Imaging (**ISBI**), 2020.

Utilizing Automated Breast Cancer Detection to Identify Spatial Distributions of Tumor-infiltrating Lymphocytes in Invasive Breast Cancer

H. Le, R. Gupta, L. Hou, S. Abousamra, D. Fassler, L. Torre-Healy, R. Moffitt, T. Kurc, D. Samaras, R. Batiste, T. Zhao, A. Rao, A. Van Dyke, A. Sharma, E. Bremer, J. Almeida, and J. Saltz. In **The American Journal of Pathology**, 2020.

Localization and Tracking in 4D Fluorescence Microscopy Imagery.

S. Abousamra, S. Adar, N. Elia, and R. Shilkrot. In CVPR Workshops - IEEE Workshop on Computer Vision for Microscopy Image Analysis (**CVMI**), 2018.

AWARDS AND RECOGNITIONS

▪ **Outstanding Reviewer, ICCV 2023.**

▪ **Articles** in *CVPR Daily Magazine, June 2023* **and** *Computer Vision News Magazine - BEST OF CVPR, July 2023* covering our paper: 'Topology-Guided Multi-Class Cell Context Generation for Digital Pathology', CVPR 2023.

▪ **Doctoral Consortium Award, CVPR 2023.**

▪ **Best Presentation in Domain Award: '**Localization in the Crowd with Topological Constraints', SBU Graduate Research Day, 2021.

▪ **Best Poster Award:** 'Automating Lifecycle-Phase Identification in Microscopy Images of Zebrafish Embryos', CEWIT'2017.

▪ **Best Paper Award:** 'Fair and Adaptive Online Set-Based Cache Partitioning', ICCES'2011.

- **Distinction with Honors - Class Rank 7th:** BSc in Computer Science and Automatic Control, 2005.

RESEARCH PROJECTS

PhD Research   Department of Computer Science, Stony Brook University, NY

- **Topology-Guided Multi-Class Cell Context Generation for Digital Pathology.**
  The biomedical domain often suffers from lack of annotations. The goal is to generate realistic pathology data where we can assign labels for use as data augmentation. We generate multi-class cell layouts (point patterns) conditioned on the spatial distribution of cells in a reference real input. Using topological and spatial statistics cell layout descriptors, we are able to capture the structural and spatial co-localization patterns and generate high quality realistic data. Developed in PyTorch.

- **Multi-Class Cell Detection Using Spatial Context Representation.**
  Pathologists classify cells by not only looking at a specific cell but also at the other classes of cells in the surrounding neighborhood. We propose a method that tries to imitate pathologists' thought process. By learning a feature representation that integrates the local spatial context and appearance, we get SOTA cell classification performance. Developed in PyTorch.

- **Crowd Localization and Cell Localization with Topological Constraints:** Crowd Localization and cell localization are closely related problems with similar challenges. Our proposed method utilizes persistence homology in training of the deep neural network to enhance the localization accuracy in both crowd counting and cell counting datasets. Developed in PyTorch.

- **Stain Decomposition in Multiplex Immunohistochemsitry (mIHC) Images:** mIHC is an innovative and cost-effective method that simultaneously labels multiple biomarkers in the same tissue section with 9 or more stains. However, analyzing and interpreting multi-colored images is a challenging task for both pathologists and current image analysis methods. We propose both unsupervised and weakly supervised deep learning methods to predict the concentration of different stains at every pixel. Developed in PyTorch.

- **Tumor Infiltrating Lymphocytes (TIL) Classification Pipeline:** Trained a deep learning model to identify TIL positive patches accurately on 23 cancer types from The Cancer Genome Atlas (TCGA). Developed an open source pipeline for whole slide image (WSI) analysis. Produced a large dataset of ~8K TIL maps for TCGA WSIs. Developed in TensorFlow, and Pytorch.

- **Microscopy Images Segmentation:** Projection of Fluorescence microscopy image z-frames is challenging in very noisy settings. In this work we propose to use adaptive noise reduction and create a compression scheme of the depth layers that maximizes the information retained. We then use convolutional neural network to localize and classify the patterns of interest. Developed in Tensorflow, and Matlab.

- **3D Hand-Pose and Finger-Touch Estimation using Depth Camera:** I used particle swarm optimization with cost function based on fingers-pose constraints to enhance the hand pose estimation coming from a convolutional neural network. I was also responsible of fingers touch pose estimation based on depth camera information, touch-finger identification, and decomposing touch blobs into their finger components. Developed in C++ and OpenCV.

CERTIFICATES

- **Coursera Deep Learning Specialization (deeplearning.ai – Instructor: Professor Andrew Ng)**:
  Certificate URL: https://www.coursera.org/account/accomplishments/specialization/5WMNZTSLXHBX

  Courses completed as part of the specialization:
  - Neural Networks and Deep Learning
  - Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization
  - Structuring Machine Learning Projects
  - Convolutional Neural Networks
  - Sequence Models

SKILLS

- ***Programming Languages****:* Python, C/C++, Java, C#, SQL, Matlab, Javascript, PHP.
- ***Development Frameworks and Tools:*** PyTorch, Tensorflow, Scikit-learn, OpenCV, OpenSlide, DGL, NetworkX.
- ***Development IDE****:* Visual Studio, Eclipse, PyCharm, MS SQL Server, Matlab.
- ***Project Management Tools****:* Github, SpiraTeam, MS Project, Visual Source Safe (VSS), Team Foundation Server (TFS).
- ***Spoken Languages****:* English, Arabic.

SERVICE

- Reviewer, IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
- Reviewer, IEEE/CVF International Conference on Computer Vision (ICCV) [*Outstanding Reviewer @ ICCV 2023*]
- Reviewer, International Conference on Machine Learning (ICML)
- Reviewer, International Conference on Learning Representations (ICLR)
- Reviewer, AAAI Conference in Artificial Intelligence (AAAI)
- Reviewer, Conference on Neural Information Processing Systems (NeurIPS)
- Reviewer, International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)
- Reviewer, Diagnostic Pathology Journal
- Reviewer, Annual Topology, Algebra, and Geometry in Machine Learning Workshop (TAGML)
- Reviewer, Machine Learning for Medical Imaging Workshop (ML4MI)

REFERENCES

- **Chao Chen**

  Assistant Professor, Department of Biomedical Informatics, Stony Brook University.

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  https://chaochen.github.io/

- **Dimitris Samaras**

  SUNY Empire Innovation Professor, Department of Computer Science, Stony Brook University.

  samaras@cs.stonybrook.edu

  https://www3.cs.stonybrook.edu/~samaras/

- **Joel Saltz**

  Cherith Professor and Founding Chair, Department of Biomedical Informatics, Stony Brook University.

  joel.saltz@stonybrookmedicine.edu

  https://bmi.stonybrookmedicine.edu/people/joel_saltz/