Naimul Mefraz Khan, PhD

Research Engineer, Sunnybrook Research Institute

E-mail: naim.13@gmail.com
Web: http://www.naimulkhan.com

Summary

Over five years of research experience in machine learning, medical imaging, and multimedia signal processing, both as a graduate researcher and as a technical lead of a fast-growing start-up company. My research has revolved around designing machine intelligence-based techniques for intuitive data visualization and exploration, with medical imaging as the principal area of application.

Research Highlights:

- ⋆ Devising novel methods for 4D ultrasound image reconstruction and tissue characterization for image-guided intervention and surgery as a research engineer at the renowned Centre for Research in Image-Guided Therapeutics at Sunnybrook Hospital.
- ⋆ Designed and developed an intuitive 3D CT volume image segmentation and visualization system using Self-Organizing Maps.
- ⋆ Proposed novel machine learning techniques that combine Support Vector Machine (SVM) and Linear Discriminant Analysis (LDA)-based methods; demonstrated application in medical image visualization.
- ⋆ Proposed a new sparse classification method for facial recognition in uncontrolled environments.
- ⋆ Developed a SLAM-based augmented reality system for mobile devices.

Leadership Achievements:

As the Research and Development Manager of AWE Company Ltd., I:

- ⋆ led a team of four software engineers to develop proprietary technologies;
- ⋆ served as the technical lead in shaping the company's future business plans;
- ⋆ represented the company at different conferences and trade shows to recruit potential clients;
- ⋆ maintained collaboration with research labs from Ryerson University and the University of Ontario Institute of Technology;
- ⋆ engaged with the legal team to file patents.

Education

- ⋆ **Ryerson University** — Toronto, ON
  PhD, Electrical and Computer Engineering — *Sep. 2010 - Sep. 2014*
  - Dissertation: *Information-Assisted Volume Rendering and Visual Evaluation through Machine Intelligence.*
  - Supervisor: Dr. Ling Guan, Canada Research Chair (Tier 1) in Multimedia and Computer Technology.
  - Co-supervisor: Dr. Baining Guo, Assistant Managing Director - Microsoft Research Asia.
- ⋆ **University of Windsor** — Windsor, ON
  M.Sc., Computer Science — *Sep. 2008 - May 2010*
  - Thesis: *Retrieval of Spatially Similar Images using Quadtree-based Indexing.*
  - Supervisor: Dr. Imran Ahmad.
- ⋆ **Bangladesh University of Engineering & Technology (BUET)** — Dhaka, Bangladesh
  B.Sc., Computer Science & Engineering — *2003-2008*

Research Experience

- **Sunnybrook Research Institute** — Toronto, ON
  Research Engineer — *Jul. 2015 - Present*
  - Working on real-time 4D image reconstruction and tissue characterization for image-guided interventions and surgery systems.

- **AWE Company Ltd.** — Toronto, ON
  Research and Development Manager — *May 2014 - Jul. 2015*
  - Technical lead involved in research, planning, development, management, execution and delivery of the company's cross-platform augmented reality software applications [PT01].
  - Led the deployment of a large-scale augmented reality experience for the City of Toronto at the Fort York National Historic site.

- **Alcohol Countermeasure Systems** — Toronto, ON
  Research Intern — *May 2014 - Aug. 2014*
  - Proposed a new sparse classification method for facial recognition in uncontrolled environments [PT02, CW01].

- **Microsoft Research Asia** — Beijing, China
  Research Intern — *Oct. 2013 - Jan. 2014*
  - Devised a novel Incremental Dynamic Time Warping method suitable for real-time sequence alignment with application in a Kinect-based physical evaluation system [CW02, JL01].

- **Ryerson University** — Toronto, ON
  Research Assistant — *Sep. 2010 - Sep. 2014*
  - Proposed new supervised and unsupervised machine learning methods for intuitive visualization and segmentation of complex 3D images [CW03-07, JL02-04].

- **University of Windsor** — Windsor, ON
  Research Assistant — *Sep. 2008 - Sep. 2010*
  - Designed several new machine learning techniques combining SVM and LDA-based approaches [CW09-10, JL05].
  - Developed an efficient indexing mechanism geared towards specialized databases for Content-based Image Retrieval Systems [CW11, JL06].

Teaching Experience

- **Ryerson University** — Toronto, ON
  Teaching Assistant — *Sep. 2010 - Sep. 2014*
  - Designed, taught, and evaluated lab classes for the following courses for multiple semesters: COE318 - Software Systems, COE618 - Object Oriented Engineering Analysis and Design, ELE888 - Intelligent Systems.
  - Taught lab classes for FIN300 - Managerial Finance for multiple semesters (class size of 200+ students).

University of Windsor — Windsor, ON
Teaching Assistant — *Sep. 2008 - Sep. 2010*
- Designed, taught, and evaluated lab classes for 3D animation, object oriented programming, introduction to programming etc.

Publications

Patents

- **[PT01]** S. Krishna, X. Nan, **N.M. Khan**, N. Dong, J.R.T Bond, L. Guan, M. Kyan, Y. He, and E. Biggs. Systems and Methods for a Shared Mixed Reality Experience. *PCT Patent No. PCT/IB2014/061672*, 2014.
- **[PT02] N.M. Khan**, X. Nan, L. Guan, and A. Quddus. A System for Video based Face Recognition using an Adaptive Dictionary. *United States Patent No. 62/098,411*, 2015.

Journals

- **[JL01]** P. Muneesawang, **N.M. Khan**, M. Kyan, B. Elder, N. Dong, G. Sun, H. Li, L. Zhong, and L. Guan. A Machine Intelligence Approach to the Design and Implementation of Ballet Training in the CAVE. *IEEE Multimedia*. [Accepted]
- **[JL02] N.M. Khan**, M. Kyan, and L. Guan. Intuitive Volume Exploration through Spherical Self-Organizing Map and Color Harmonization. *Neurocomputing*, vol. 147 pp. 160-173, 2015. [**Invited Article**]
- **[JL03] N.M. Khan**, R. Ksantini, I.S. Ahmad, and L. Guan. Covariance-guided One Class Support Vector Machine. *Pattern Recognition*, vol. 47 no. 6 pp. 2165-2177, 2014.
- **[JL04] N.M. Khan**, R. Ksantini, I.S. Ahmad, and L. Guan. SN-SVM: A Sparse Nonparametric Support Vector Machine Classifier. *Signal, Image and Video Processing*, vol. 8 no. 8 pp. 1625-1637, 2014.
- **[JL05] N.M. Khan**, R. Ksantini, I.S. Ahmad, and B. Boufama. A novel SVM+NDA model for classification with an application to face recognition. *Pattern Recognition*, vol. 45 no. 1 pp. 66-79, 2012.
- **[JL06] N.M. Khan** and I.S. Ahmad. An Efficient Signature Representation for Retrieval of Spatially Similar Images. *Signal, Image and Video Processing*, vol. 6 no. 1 pp. 55-70, 2012. [**Invited Article**]

Conferences and Workshops

- **[CW01] N.M. Khan**, X. Nan, A. Quddus, and L. Guan. On Video Based Face Recognition Through Adaptive Sparse Dictionary. *IEEE International Conference on Automatic Face and Gesture Recognition*. [Accepted]
- **[CW02] N.M. Khan**, S. Lin, L. Guan, and B. Guo. A Visual Evaluation Framework for In-Home Physical Rehabilitation. *IEEE International Symposium on Multimedia (ISM 2014)*, pp. 237-240, 2014.
- **[CW03] N.M. Khan**, R. Ksantini, and L. Guan. Volume Visualization Using Sparse Nonparametric Support Vector Machines and Harmonic Colors. *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2014)*, pp. 6607-6611, 2014.
- **[CW04] N.M. Khan**, M. Kyan, and L. Guan. ImmerVol: An Immersive Volume Visualization System. *IEEE International Conference on Computational Intelligence and Virtual Environments for Measurement Systems and Applications (CIVEMSA 2014)*, pp. 24-29, 2014.
- **[CW05] N.M. Khan**, R. Ksantini, I.S. Ahmad, and L. Guan. Incorporating Covariance Information in One Class Support Vector Classification. *IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2013)*, pp. 3552-3556, 2013.
- **[CW06] N.M. Khan**, M. Kyan, and L. Guan. Intuitive Volume Exploration through Spherical Self-Organizing Map. *Workshop on Self-Organizing Map (WSOM 2012)*, pp. 75-84, 2012.
- **[CW07] N.M. Khan**, R. Ksantini, I.S. Ahmad, and L. Guan. A Sparse Support Vector Machine Classifier with Nonparametric Discriminants. *International Conference on Artificial Neural Networks (ICANN 2012)*, pp. 330-338, 2012.
- **[CW08] N.M. Khan** and K. Raahemifar. A novel Accelerated Greedy Snake Algorithm for active contours. *Canadian Conference on Electrical and Computer Engineering (CCECE 20111)*, pp. 186-190, 2011.

- **[CW09]** R. Ksantini, B. Boufama, I.S. Ahmad, and **N.M. Khan**. A New Combined KSVM and KFD Model for Classification and Recognition. *International Conference on Digital Information Management (ICDIM 2010)*, pp. 188-193, 2010.
- **[CW10] N.M. Khan**, R. Ksantini, I.S. Ahmad, and B. Boufama. A New SVM + NDA Model for Improved Classification and Recognition. *International Conference on Image Analysis and Recognition (ICIAR 2010)*, pp. 127-136, 2010.
- **[CW11] N.M. Khan** and I.S. Ahmad. A New Signature for Quadtree based Image Matching. *International Conference on Advances in Mobile Computing and Multimedia (MoMM 2009)*, pp. 20-27, 2009.

Awards, Achievements & Activities

- *OCE TalentEdge Postdoctoral Fellowship*, 2014-2016.
- *Ontario Graduate Scholarship*, 2013-14.
- *Queen Elizabeth II Graduate Scholarship in Science and Technology*, 2012-13.
- *Ryerson Graduate Scholarship*, Ryerson University, 2010-2012.
- Nominated as one of the two students from Ryerson University for 2012-2013 Vanier Canada Graduate Scholarship (final ranking: 55 among all Canadian graduate students).
- *Graduate Student Achievement Award* (1st place), University of Windsor, 2010.
- Served as program committee member and reviewer of several conferences and journals, such as ICME, IEEE Transactions on Multimedia etc.
- Volunteering: Emergency Responder for *RyeSERT (Ryerson Student Emergency Response Team)*.

Skills

Tools: Visualization Toolkit (VTK), OpenCV, OpenSceneGraph, MATLAB.

Programming Languages: C, C++, Java, C#.

Mobile: Experience in developing computer vision libraries using Android NDK and SDK.

3D Software: Unity 3D, Maya.

References

- Dr. Ling Guan
  Professor, Canada Research Chair, Department of Electrical and Computer Engineering
  Ryerson University, 350 Victoria Street, Toronto, ON M5B 2K3.
  E-Mail : lguan@ee.ryerson.ca. Phone: +1-416-979-5000 x6072.
- Dr. Baining Guo
  Assistant Managing Director
  Microsoft Research Asia, No. 5 Dan Ling Street, Haidian District, Beijing, P.R. China, 100080.
  E-Mail : bainguo@microsoft.com. Phone: +86-10-5917-8888.
- Dr. Azhar Quddus
  Research Scientist, Biometrics
  Alcohol Countermeasure Systems, 60 International Boulevard, Toronto, ON M9W 6J2.
  E-Mail : aquddus@acs-corp.com. Phone: +1-416-619-3500 x3815.