MATH-IMS Joint Applied Mathematics Colloquium Series
The Chinese University of Hong Kong

This MATH-IMS Joint Colloquium Series is organized by Center for Mathematical Artificial Intelligence (CMAI), under Department of Mathematics and Institute of Mathematical Sciences (IMS) at The Chinese University of Hong Kong. The colloquium series focuses on mathematics and applications of artificial intelligence, big data and related topics.

Date: January 26, 2021 (Tuesday)
Time: 4pm – 5pm (Hong Kong Time)
Zoom Link: https://cuhk.zoom.us/j/92775210812

On Learning Geometry, Towards a Semi-supervised Axiomatic Approach
Speaker: Professor Ron Kimmel, Technion

Abstract: Deep learning is a disruptive line of research that changes the way computational problems are being addressed and solved. Many parameters are optimized for, and tuned to train a given computational architecture to classify, segment, identify, and reconstruct objects. This methodology works great as long as there is some assumption about the dimensionality of the data, or its spatial or temporal shift invariance property that allow convolutional neural networks to operate on the given data. The question we address is what can be done for geometric structures for which there is no linear shift invariance mechanism to rely on. We will learn to match geometric structures by searching for the Gromov distance between metric spaces, we will measure geodesic distances while learning to solve Eikonal equations, we classify objects by realizing that learning to lift coordinates into high dimensional latent spaces could be related to classical moments. In general, we show that importing axiomatic constructions into the learning arena gives birth to novel semi-supervised learning procedures that could outperform existing methods. Finally, if time permits, I will comment on an interesting line of research we have started to explore dealing with computational pathology.
Keywords: Gromov Hausdorff Distance, Functional Maps Net, PointNet, Fast Marching Method, Scale Invariant Laplace Beltrami Operator (SI-LBO), Spectral Decomposition

Bio: Professor Ron Kimmel holds a D.Sc. degree in electrical engineering in 1995 from the Technion - Israel Institute of Technology. He held a post-doctoral position at UC Berkeley and a visiting professorship at Stanford University. He is currently a Professor of Computer Science at the Technion, where he holds the Montreal Chair in Sciences. Professor Kimmel has made tremendous contributions to image and shape analysis in computer vision, image processing, and computer graphic. He is well known for his development of fast marching methods for triangulated manifolds, the geodesic active contours algorithm for image segmentation, the Beltrami flow for image filtering and the Generalized Multidimensional Scaling. Because of his significant research achievements, he has received numerous awards and recognitions, including the SIAG Imaging Science Best Paper Prize in 2013 and 2016, Helmholtz Prize in 2013, Counter Terrorism Award in 2003, Henry Taub Prize in 2001, as well as the Hershel Rich innovation award in 2001 and 2003. He was elected as an IEEE fellow in 2009 and a SIAM fellow in 2019.