

*University of Chemistry and Technology in Prague  
Department of Computing and Control Engineering  
Czech Technical University in Prague  
Czech Institute of Informatics, Robotics and Cybernetics & Faculty of Mechanical Engineering*

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We are pleased to invite you to attend the lecture of

*Professor Nick Kingsbury, Doctor Honoris Causa, CTU in Prague  
University of Cambridge, Department of Engineering, UK*

## **HOW SCATTERNETS CAN HELP DEEP NETWORKS TO LEARN AND BE MORE COMPREHENSIBLE**

The lecture will take place on August 30<sup>th</sup>, 2016 at 10:15 a.m. at the Faculty of Mechanical Engineering of the Czech Technical University in Prague (Technická 4, 16628 Prague 6, ground floor, the first corridor to the left, conference room 17).

### *Lecture Summary*

*Scatternets [Bruna & Mallat, IEEE Trans PAMI 2013] are convolutional network layers in which the filters are largely defined by wavelet transforms and whose layer non-linearities are typically complex modulus (L2-norm) operators. Usually they are pre-designed using standard complex wavelet design methodologies that are based on accumulated human knowledge about vision systems, and they involve minimal training. It is found that several layers of scatternet can replace the early layers of a deep convolution neural net (CNN). The aim of this strategy is that the deterministic and complete nature of the wavelet transformations will result in deep networks that are faster at learning, more comprehensible in their behaviour and perhaps better at generalisation than a CNN which has to learn all of its layers from finite amounts of training data. Furthermore, by employing tight-frame overcomplete wavelets and L2-norm nonlinearities, signal energy may be conserved through the scatternet layers, leading to some interesting strategies for subspace selection.*

*In this talk we shall suggest a number of ways that scatternets, based on dual-tree wavelets, may be incorporated into CNNs and also show how recent ideas on CNN layer visualisation can be extended to include the scatternet layers too. We shall pose more questions than answers, while also presenting results from the early stages of this work. My co-researchers on this project are Amarjot Singh and Fergal Cotter.*