

# CS Seminar

## ***Deep Composer: Music Generation Using Deep Neural Hashing***

**Prof. Kien A. Hua**  
**Pegasus Professor and Director of the Data Systems Lab**  
**University of Central Florida**

**Date:**

**August 21, 2019**  
**Wednesday**  
**2:00 pm**

**Venue:**

**Room 308**  
**Chow Yei Ching Building**  
**The University of Hong Kong**

**Abstract:**

Recurrent neural networks have successfully generated pleasing melodies; however, they have struggled to create a full piece that has structure, theme, and originality. To overcome this limitation, we discuss a music retrieval approach for music generation. Composability, instead of the usual similarity, is used as the metric for retrieval. The musical segments (tiny building blocks each with only 16 music notes) in the database are encoded using a deep hashing method to facilitate the composability retrieval. Music composition is performed by using the current segment as a query to retrieve the next composable segment from the database until the song is complete. This encoding scheme incorporates both theme and structure so that musical segments can be joined to generate a piece that is both unique and pleasing to listen to. Each music segment is assigned four hash codes learned by a multi-LSTM system, each defining the given segment's compatibility with other segments for a distinct structural location (beginning, middle, or ending section) in the piece. Additionally, a two-phase music segmentation technique captures structural information while minimizing the segment length. We compare this scheme to multiple recent music generation methods using both objective and subjective evaluation metrics to demonstrate that the pieces generated by our Deep Composer system are not only unique and musically pleasing but also contain more structure and theme features like that of a professionally composed piece. A secondary goal of this research is to bring back the great composers (e.g., Mozart, Chopin, Beethoven, ...) to compose their new original music for us today by using their music segments as the building blocks. In fact, the best composers of different times would be able to collaborate today through the Deep Composer. Deep Composer can also generate world fusion music beyond the capacity of any human composers.

**About the Speaker:**

Dr. Kien A. Hua is a Pegasus Professor and Director of the Data Systems Lab at the University of Central Florida. He was the Associate Dean for Research of the College of Engineering and Computer Science at UCF. Prior to joining the university, he was a Lead Architect at IBM Mid-Hudson Laboratory, where he led a team of senior engineers to develop a highly parallel computer system, the precursor to the highly successful commercial parallel computer known as SP2. More recently, Prof. Hua was serving as a domain expert on spaceport technology at NASA, and a data analytics expert to advise the U.S. Air Force on the Air Force Strategy 2030 Initiative.

Prof. Hua received his B.S. in Computer Science, and M.S. and Ph.D. in Electrical Engineering, all from the University of Illinois at Urbana-Champaign, USA. His current research interest includes music generation, deep learning, multimedia database and analytics, network and wireless communications, and the Internet of Things. He has published widely, with 15 papers recognized as best/top papers at a conference and one as the best paper of the year for a journal. Dr. Hua introduced peer-to-peer communications and data sharing in 1997, that has inspired many impactful applications including the Blockchain technology today. He introduced graph-based data mining at the 1999 International Conference on Data Warehousing and Knowledge Discovery; and the paper was recognized as a best paper at this conference. He is also a pioneer in the Internet of Things, with the WISE (Web-based Intelligent Sensor Explorer) prototype introduced in 2004, probably the first IoT platform implemented. It enables publishing, searching, and sharing of connected sensing devices. More recently, he developed a novel router in 2015, that transform network congestion into advantage. His other research works such as Skyscraper Broadcasting, Patching, and Zigzag all have been heavily cited and have inspired many commercial systems in use today. Prof. Hua has served as a Conference Chair, an Associate Chair, and a Technical Program Committee Member of numerous international conferences, and on the editorial boards of several professional journals. More recently, he served as a General Co-Chair for the 2014 ACM Multimedia conference; and he is currently organizing the 2018 IEEE International Conference on Cloud Engineering (IC2E) and serving as a General Co-Chair. Prof. Hua is a Fellow of IEEE.

**All are welcome!**

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