KEYNOTE TALK

Wednesday, October 6, 2021 at 1:30pm

Learning and accruing knowledge over time using modular architectures

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Abstract: A typical trait of any intelligent system is the ability to learn new skills quickly without too many interactions with a teacher. Over time we also would expect an intelligent system to become better at solving new tasks, coming up with a better solution in even less time if the new task relates to something already learned in the past. While nowadays machine learning methods excel at learning a single task from large amounts of labeled data, and more recently, even from little labeled data provided suitable pretraining on a vast amount of unlabeled data, knowledge is seldom accrued over time. Whenever more data and compute are available, bigger models are often retrained from scratch. In this talk, I argue that by considering the sequence of learning tasks, and more generally, the sequential nature of the data acquisition process, we may grant our artificial learners an unprecedented opportunity to transfer knowledge and even accrue knowledge over time, potentially leading to more efficient and effective learning of future tasks. From the modeling side, I will introduce a few variants of hierarchical mixtures of experts, which are deep modular networks. These architectures are appealing for a twofold reason. First, since they are modular it is natural to add modules over time to accommodate the acquisition of new knowledge. The modularity also leads to computational efficiency since run time can be made constant with respect to the number of modules. Second, by recombining modules in novel ways compositional generalization emerges, yielding learners that learn faster as time goes by. I will demonstrate these ideas on several learning settings applied to vision, namely compositional 0-shot learning, continual learning and anytime learning. Although these are admittedly baby steps towards our grand goal, I believe there is an untapped potential for more effective and efficient learning once we frame learning as a life-long learning experience.

Speaker Bio-Sketch: Marc'Aurelio Ranzato is a research scientist at DeepMind in London. His research interests are in the area of unsupervised learning, continual learning and transfer learning, with applications to vision, natural language understanding and speech recognition. In 2009 Marc'Aurelio earned a PhD in Computer Science at New York University under Yann LeCun's supervision. After a postdoc with Geoffrey Hinton at University of Toronto, he joined the Google Brain team in 2011. In 2013 he moved to Facebook and was a founding member of the Facebook AI Research lab. He then joined DeepMind in 2021. Marc'Aurelio has served as program chair for ICLR 2017, ICLR 2018 and NeurIPS 2020. He is now serving as the general chair of NeurIPS 2021.