



**New Driving Forces: Neural Processing Unit and Neuromorphic Processor**  
**Youngnam Hwang, Principal Engineer, Samsung Electronics**

To meet the ever-increasing computing needs, especially driven by the application of Machine Learning in several fields, the computing industry has entered an era of domain specific architecture, in which neural processing unit (NPU) and neuromorphic processor are actively being developed. As the merits of progressing Moore's Law are slowing down, general-purpose computing systems face serious challenges in terms of improving performance, energy and cost. However, Machine Learning applications require still higher performance and lower energy at a minimum cost.

NPU provides a potential solution to it by pursuing low precision, high utilization, heterogeneity and reconfigurability in architecture design. With help of algorithms, data word size is being significantly reduced. Various architectures such as SIMD and dataflow compete with each other to increase utilization of processing elements. Heterogeneous architecture is also proposed to optimize compute-centric and memory-centric applications respectively. Reconfigurability provides hardware flexibility to keep up with fast-progressing Machine Learning algorithms.

Neuromorphic processors can provide a more innovative solution by implementing neural networks into hardware itself, which results in much lower power and shorter latency. Much research on synapse devices are being performed, especially focusing on nonvolatile memories. Moreover, many algorithms are being investigated to mitigate the requirements for the synapse devices, which put forward the advent of commercial neuromorphic processors.