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CECS Seminar

"GOAL: An Industrially Validated Global Optimization Framework for Advanced Macro Placement in Semiconductor Design"



Jooyoung Lee

Professor Emeritus, KIAS
CEO, Good Intelligence

Friday, February13th
10:30-11:30 a.m.
Location: EH 2430

Abstract:

Most current AI solutions in industry rely on LLM architectures, which are fundamentally unsuited for high-dimensional combinatorial optimization. In contrast, we target problem classes that LLMs and conventional reinforcement learning (RL) cannot solve. System-level macro placement in advanced semiconductor design represents an extremely large-scale combinatorial optimization space, with a search complexity exceeding astronomical scales. Prior RL-based approaches from major EDA vendors and research groups have not translated into production-level performance, largely due to sparse and ambiguous reward structures in real-world design constraints.

Our CSA global-optimization framework is engineered specifically for such non-convex, high-dimensional search problems. Its performance has been validated through back-to-back victories in The Critical Assessment of Protein Structure Prediction (CASP) and through "Badugi," the first Korean AI system to defeat a professional Go player, both demonstrating its capability to navigate vast, rugged solution landscapes. We have collaborated with a leading global semiconductor manufacturer to evaluate our technology on a top-tier, cutting-edge semiconductor device. The CSA-based macro-placement engine produced layouts superior to those of veteran human designers and showed strong potential to reduce overall physical-design cycle time by more than half. Unlike costly RL-driven, general-purpose optimization tools, our solution is built on a dedicated combinatorial-optimization engine that directly models the search space rather than relying on proxy rewards. We are advancing AI that can reliably solve the hardest optimization problems in semiconductor design and beyond.

Biography:

Prof. Jooyoung Lee, Good Intelligence CEO, received his PhD in Physics in 1990 from Brown University under the supervision of Prof. JM Kosterlitz (2016 Nobel laureate in Physics). Since 1994, his research focused on solving the protein folding problem, and he led a KIAS (Korea Institute for Advanced Study) team in the CASP (protein structure modeling) competition for CASP5-CASP12 (2002-2016). Motivated by the superhuman performance of AlphaGo, with an ultimate eye towards improvements in protein folding prediction, Prof. Lee's research interest temporarily turned to deep learning. He started with its application to the game of Go, and implemented a unique deep learning method to compete in world Go AI competitions (2nd place in the 2019 Fuzhou Go AI competition; 3rd place in the 11th Computer Go UEC Cup).

Hosted By: Prof. Ian Harris