

## **A Multi-discipline Approach to Advancing Knowledge Distillation and its Applications**

MengChu Zhou, Ph.D. & Dist. Professor

Fellow of IEEE, IFAC, AAAS, CAA and NAI

Abstract— knowledge distillation is among the core technologies in the area of Artificial Intelligence and its deployment allows users to enjoy many applications at their resource-constrained end devices like mobile phones. Existing studies on knowledge distillation focus on teacher-centered methods, in which the teacher network is trained according to its own standards before transferring the learned knowledge to a student one. However, due to differences in network structure between teacher and student ones, the knowledge learned by the former may not be truly desired by the latter. Inspired by human educational wisdom, we propose a Student-Centered Distillation (SCD) method that enables the teacher network to adjust its knowledge transfer according to the student's true needs. We implement it based on various human educational wisdom, e.g., the teacher network identifies and learns the knowledge desired by the student network on the validation set, and then transfers it to the latter through the training set. To address the problems of current deficiency knowledge, hard sample learning and knowledge forgetting faced by a student network in the learning process, we introduce and improve Proportional-Integral-Derivative (PID) algorithms from the field control systems to make them effective in identifying the current knowledge required by the student network. Furthermore, we propose a curriculum learning-based fuzzy strategy and apply it to the proposed PID control algorithm, such that the student network can actively pay attention to the learning of challenging samples. Experimental results show that SCD outperforms existing teacher-centered ones in many computer vision tasks from object detection to image segmentation.