DeepSwarm: Towards Swarm Deep Learning with Bi-directional Optimization of Data Acquisition and Processing

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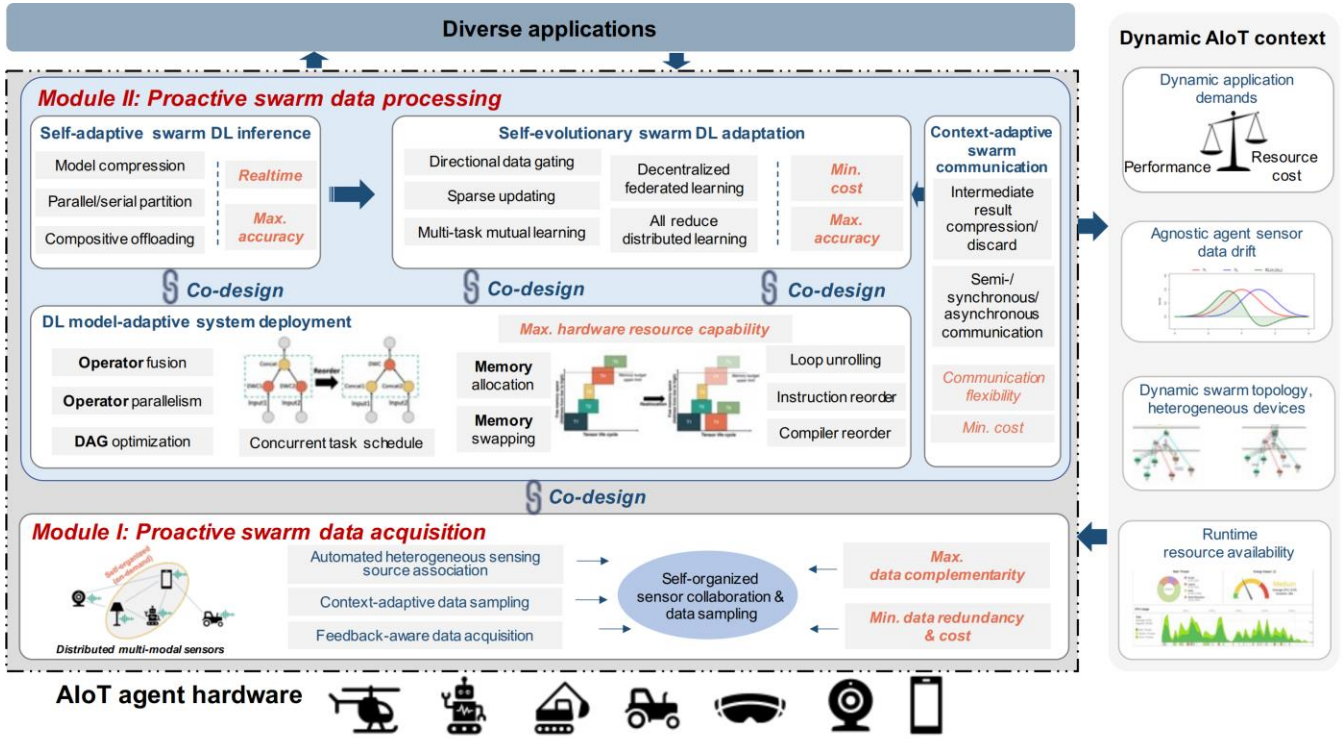
Current Problem: The rise of on-device deep learning (DL) in resource-limited mobile and embedded devices has stimulated various applications. However, existing on-device DL mostly relies on predefined processing patterns for reacting to given input data, resulting in accuracy and resource efficiency bottlenecks.



Our thoughts:

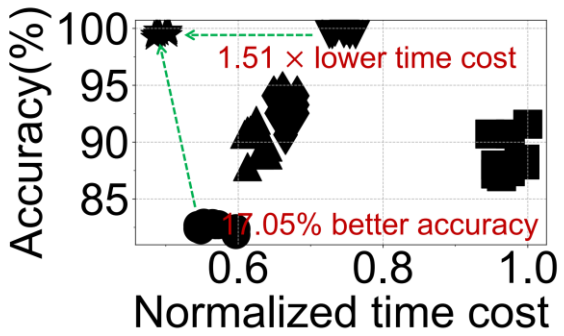
- ✓ DeepSwarm incorporates proactive data acquisition and processing with bi-directional optimization to minimize redundancy and enhance resource efficiency.
- ✓ It promptly addresses data limitations and redundancy through DL feedback, capitalizing on the complementary and asynchronous nature of data for scalable processing.

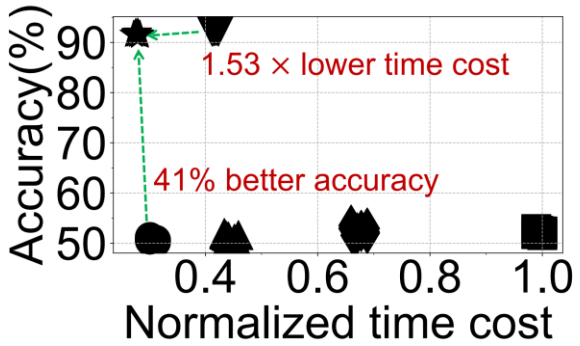
Deep Swarm

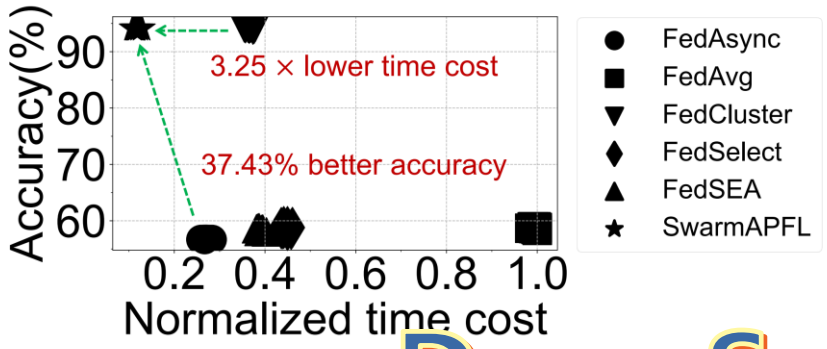
DeepSwarm for Swarm DL Adaptation: Compared with the original model of the mobile model, DeepSwarm has improved the average accuracy by more than 40%, and compared with the global model, it has improved by 9%.

Method	Accuracy gain of global model	Accuracy of mobile model after adaptation				Accuracy gain of mobile model			
	IoU = 0.5	IoU = 0.50				IoU = 0.50			
		Mobile model A	Mobile model B	Mobile model C	Average	Mobile model A	Mobile model B	Mobile model C	Average
Domain adaptation	None	0.504	0.469	0.497	0.49	14.3%	48.9%	13.7%	23.4%
NestEvo without data generation	1.3%	0.504	0.475	0.501	0.505	14.3%	50.8%	15.5%	27.2%
Original mobile model	None	0.441	0.315	0.437	0.397	None			
Only mobile model adaptation	0	0.501	0.478	0.493	0.491	13.6%	51.7%	12.8%	23.7%
NestEvo	9.13%	0.571	0.543	0.584	0.566	29.5%	72.4%	33.6%	42.6%

DeepSwarm for Asy nchronous Personalized FL: The results showed that DeepSwarm achieves a reduction of up to $88.2%$ in convergence time, and an improvement of up to 46% in accuracy.







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