# GANNO

## Generalisable Agents for Neural Network Optimisation

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*Multi-agent reinforcement learning can yield effective layerwise learning rate schedules.*

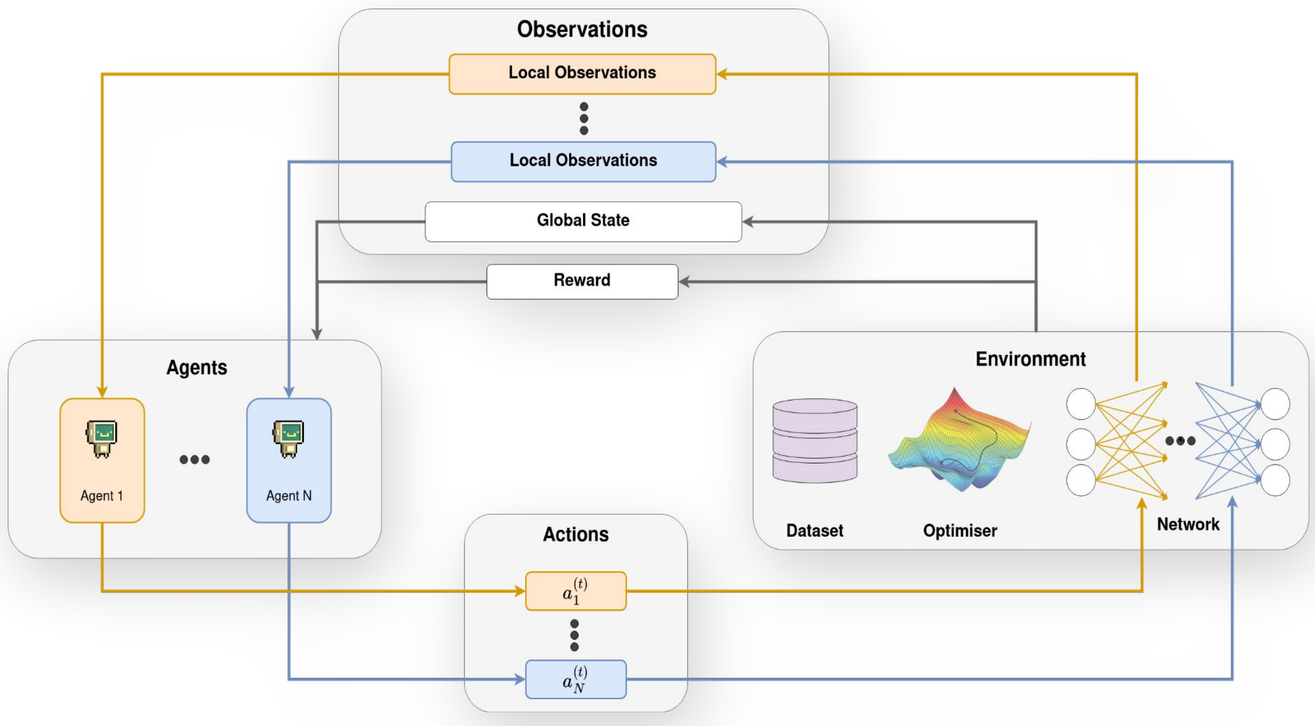
***Background:*** Existing strategies for choosing hyperparameters struggle to simultaneously satisfy the requirements of **performance**, **efficiency**, and **generalisability**.

***Goal:*** Create a general method for learning optimisation schedules for supervised learning.

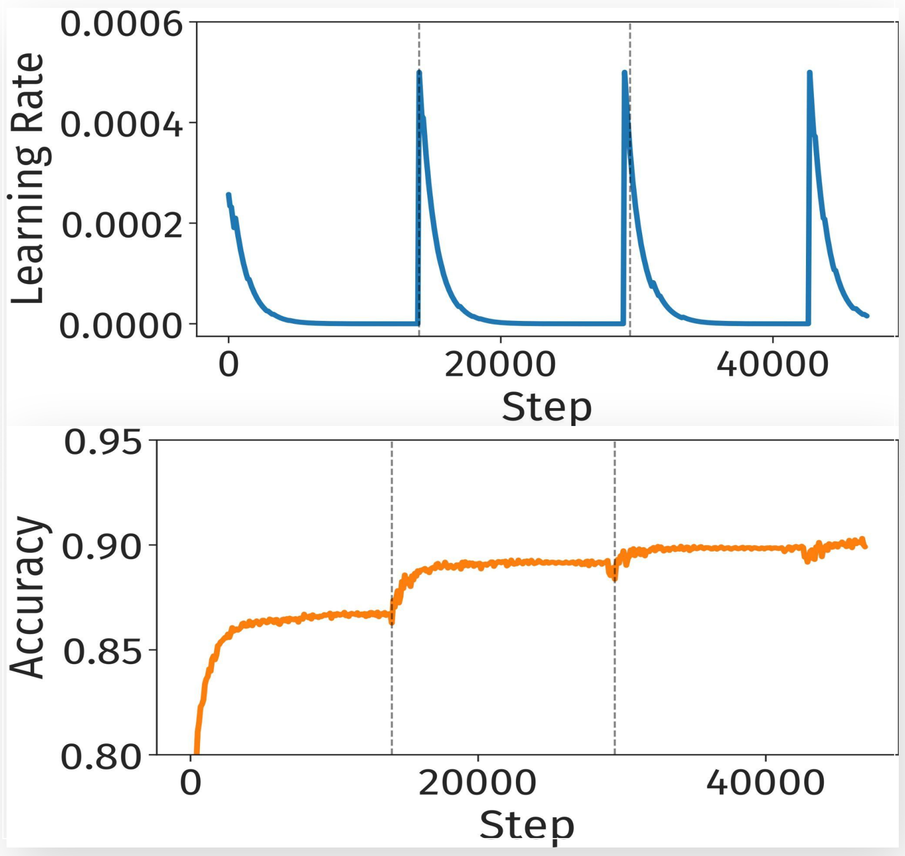
https://bit.ly/id-ganno

## *Method:*

- RL outer loop, with a supervised learning inner loop.
- Agents receive *layerwise* observations of network dynamics.
- Agents take actions that adjust the learning rate.
- The inner neural network is trained for 100 steps.
- Reward is the test accuracy on the holdout dataset.
- Agents are trained on easy problems (e.g. 2-layer CNN on MNIST) and evaluated on harder problems (e.g. 5-layer CNN on CIFAR-10) to test generalisation.

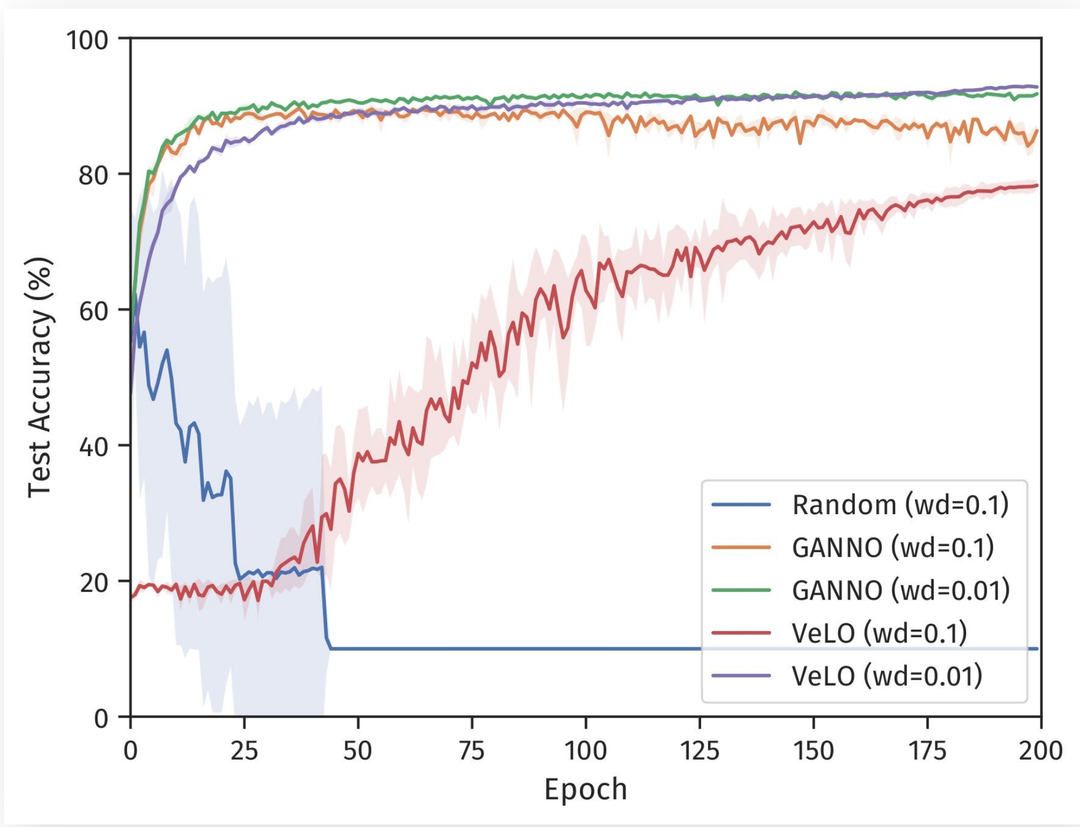



## *Findings:*




### GANNO learns adaptive schedules

- The agent is able to **learn a cyclical learning rate** similar to SGDR.
- This learning rate is **reactive** to plateaus and able to **help escape local minima.**




### GANNO generalises to more complex architectures

- GANNO is trained with **ResNet-9** and **generalises to ResNet-18.**
- GANNO is **trained with varying initial learning rates** and weight decay values, so that it is **robust during evaluation.**

***Conclusion:*** MARL proves crucial for GANNO's success, enabling adaptive layerwise learning rates, achieving generalisation, with only modest computational requirements. Challenges persist in agent foresight and reward formulation, and some handcrafted schedules still outperform GANNO; yet the proposed framework is evidently a powerful one.

NEURAL INFORMATION PROCESSING SYSTEMS

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