NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

School of Computer Science and Engineering
College of Engineering

Overparameterisation for Single and Multi-Task Learning

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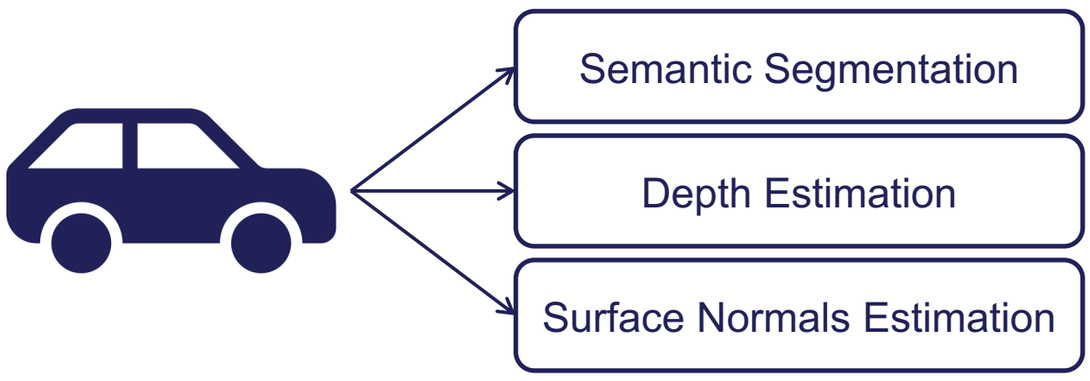
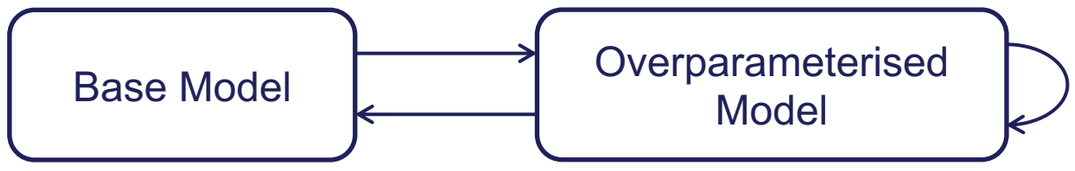
BACKGROUND



Autonomous vehicles make use of computer vision techniques to make sense of their environments. Some constraints are:

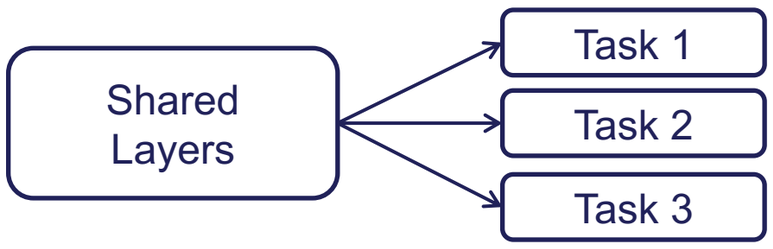
- Inference need to be performed at high performance within latency and hardware accelerator constraints
- Multiple tasks need to be solved at the same time

Overparameterisation



Overparameterisation is a technique to improve model performance with equal parameter size at inference time (e.g. FNL[1], RepVGG[2]).

Multi-Task Learning

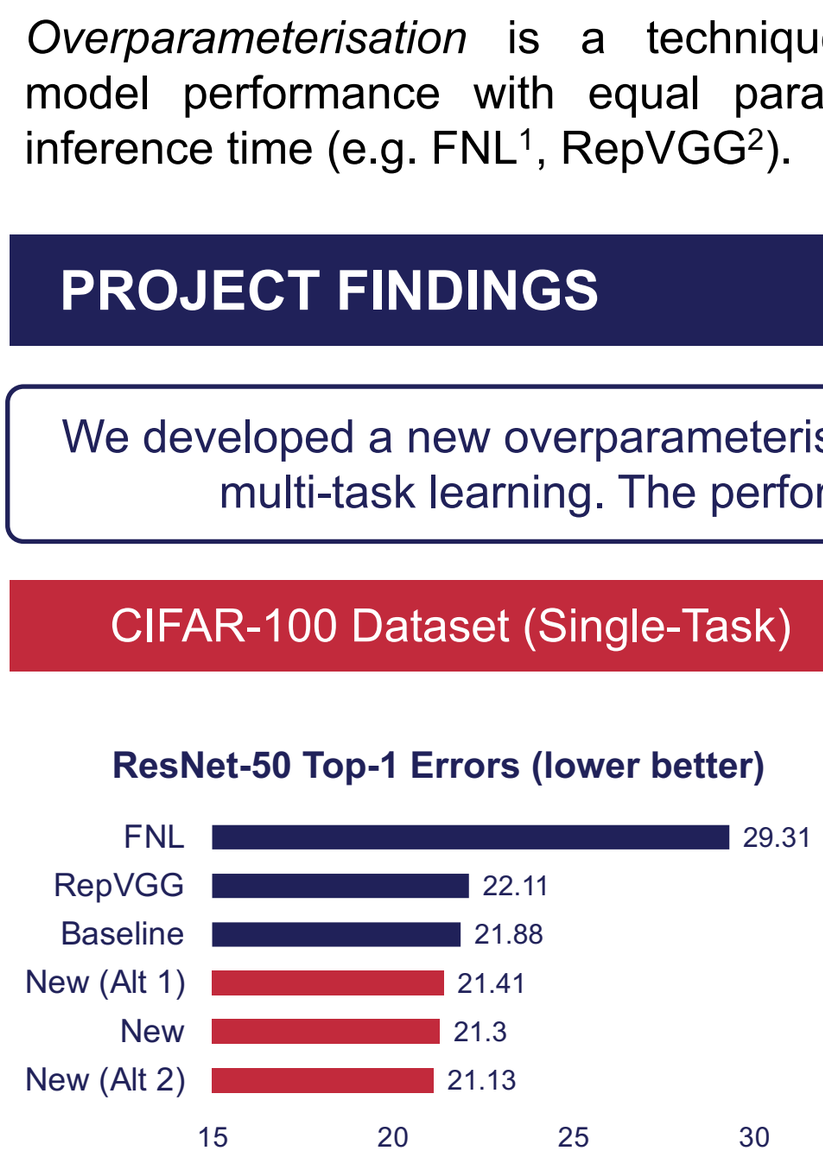


Multi-task learning attempts to solve multiple tasks simultaneously using a single model, such as through shared layers and task-specific layers[3].

PROJECT FINDINGS

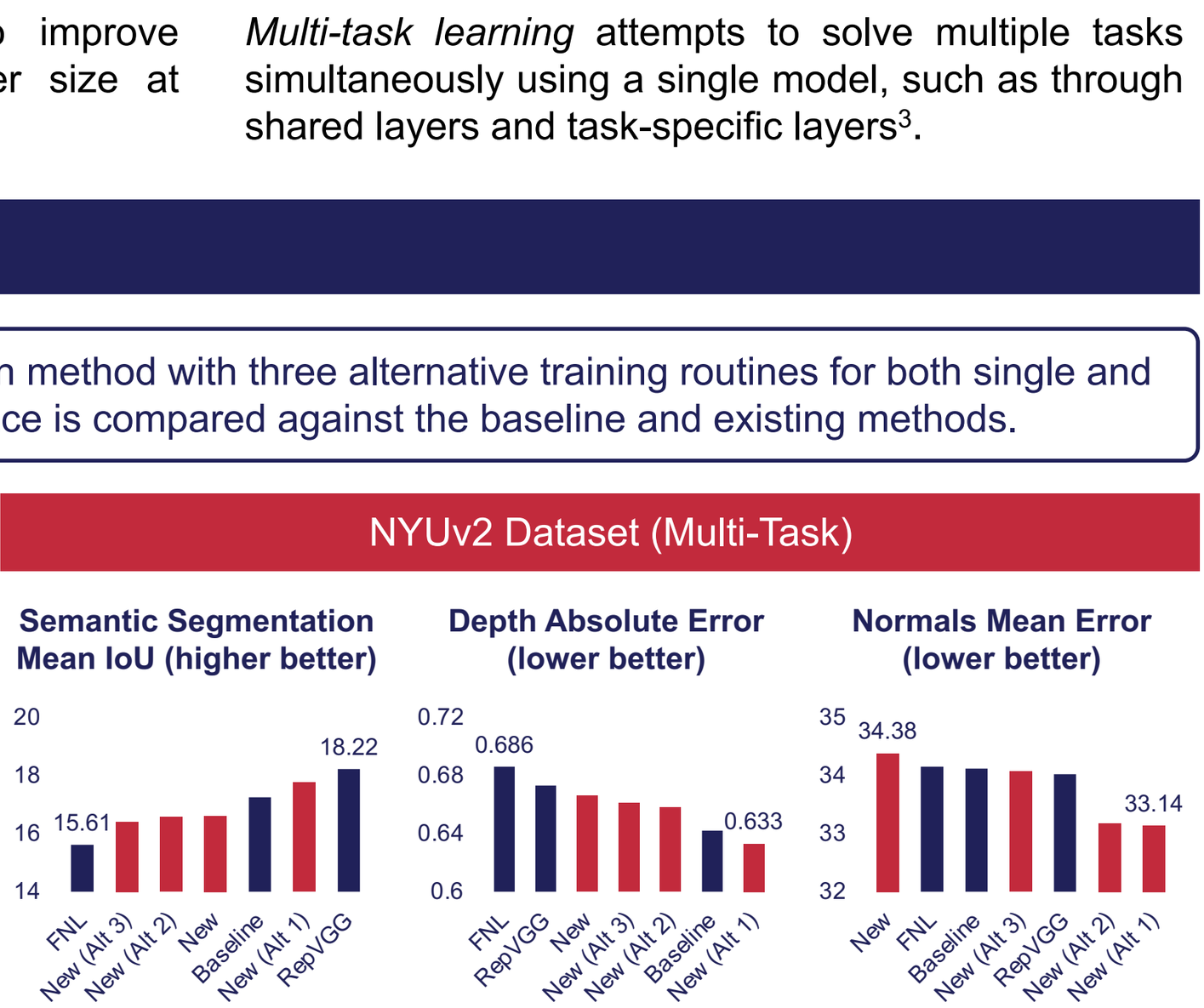
We developed a new overparameterisation method with three alternative training routines for both single and multi-task learning. The performance is compared against the baseline and existing methods.

CIFAR-100 Dataset (Single-Task)



Our new method achieves exceptional performance with CIFAR-100, beating the baseline and existing methods, FNL and RepVGG.

NYUv2 Dataset (Multi-Task)



Our new method with alternative training routine 1 has achieved the best performance for depth estimation and surface normals estimation. However, RepVGG achieved a better performance in semantic segmentation, though our method still beats the baseline.

[1] Khodak, M., Tenenholtz, N., Mackey, L., & Fusi, N. (2021). Initialization and regularization of factorized neural layers. arXiv preprint arXiv:2105.01029.
[2] Ding, X., Zhang, X., Ma, N., Han, J., Ding, G., & Sun, J. (2021). RepVGG: Making VGG-style ConvNets great again. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (pp. 13733-13742).
[3] Crawshaw, M. (2020). Multi-task learning with deep neural networks: A survey. arXiv preprint arXiv:2009.09796.