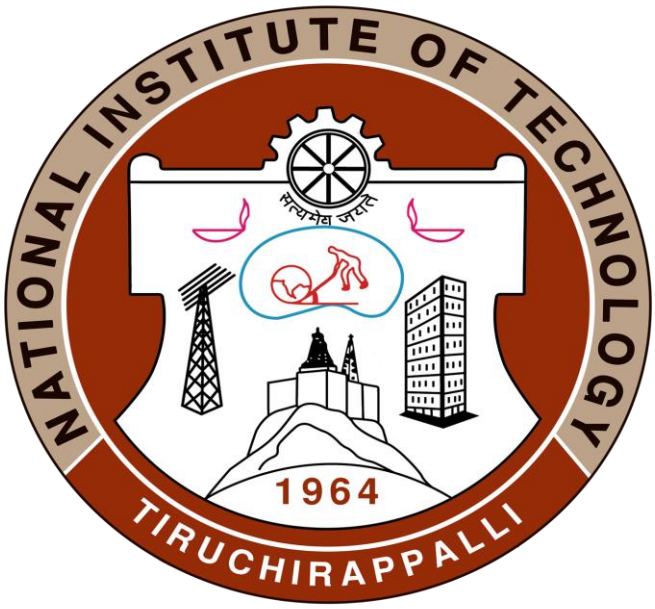
National Institute of Technology, Tiruchirappali



Lab Project

Submitted By – 205121054
Submitted to Divakar sir

Aim

To run a ml model based on Fast Neural Architecture Search of Compact Semantic Segmentation models via Auxiliary Cells.

Objective

To run three pretrained segmentation model on PASCAL VOC Dataset.

Abstract

Automated design of neural network architectures tai-lored for a specific task is an extremely promising, albeit inherently difficult, avenue to explore. While most results in this domain have been achieved on image classification and language modelling problems, here we concentrate on dense per-pixel tasks, in particular, semantic image seg-mentation using fully convolutional networks. In contrast to the aforementioned areas, the design choices of a fully convolutional network require several changes, ranging from the sort of operations that need to be used—e.g., dilated convolutions—to a solving of a more difficult optimisation problem. In this work, we are particularly interested in searching for high-performance compact segmentation ar- chitectures, able to run in real-time using limited resources. To achieve that, we intentionally over-parameterise the architecture during the training time via a set of auxiliary cells that provide an intermediate supervisory signal and can be omitted during the evaluation phase. The design of the auxiliary cell is emitted by a controller, a neural net-work with the fixed structure trained using reinforcement learning. More crucially, we demonstrate how to efficiently search for these architectures within limited time and computational budgets. In particular, we rely on a progressive strategy that terminates non-promising architectures from being further trained, and on Polyak

averaging coupled with knowledge distillation to speed-up the convergence. Quantitatively, in 8 GPU-days our approach discovers a set of architectures performing on-par with state-of-the-art among compact models on the semantic segmentation, pose estimation and depth prediction tasks.

Issues this model solves:

- Devises a progressive strategy able to eliminate poor candidates early in the training.
- Producing an efficient neural architecture search strategy for dense-per-pixel tasks
- Developing a training schedule for semantic segmentation able to provide solid results quickly via the means of knowledge distillation and Polyak averaging.
- Searching for an over-parameterised auxiliary cell that provides better training and is obsolete during inference.

Diagram:

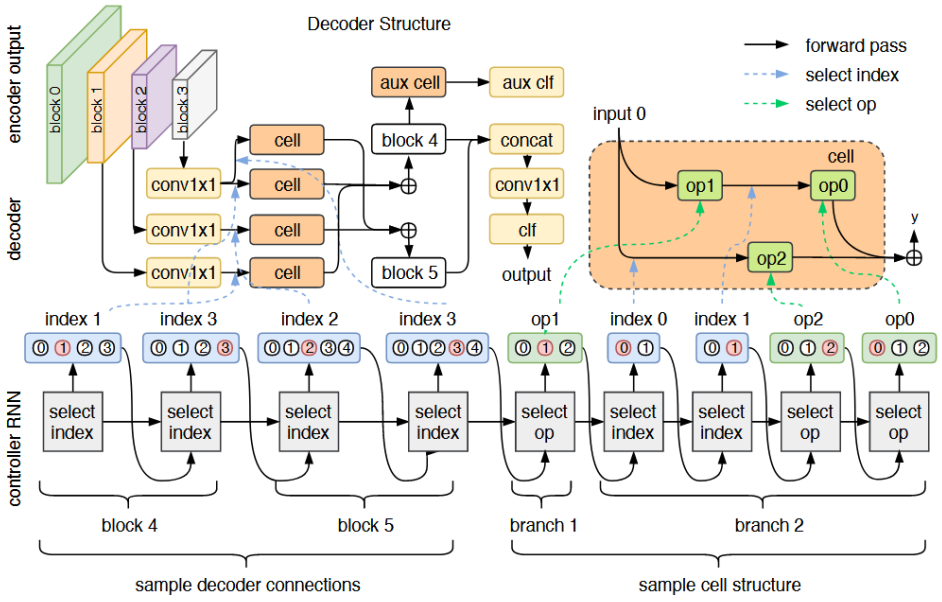
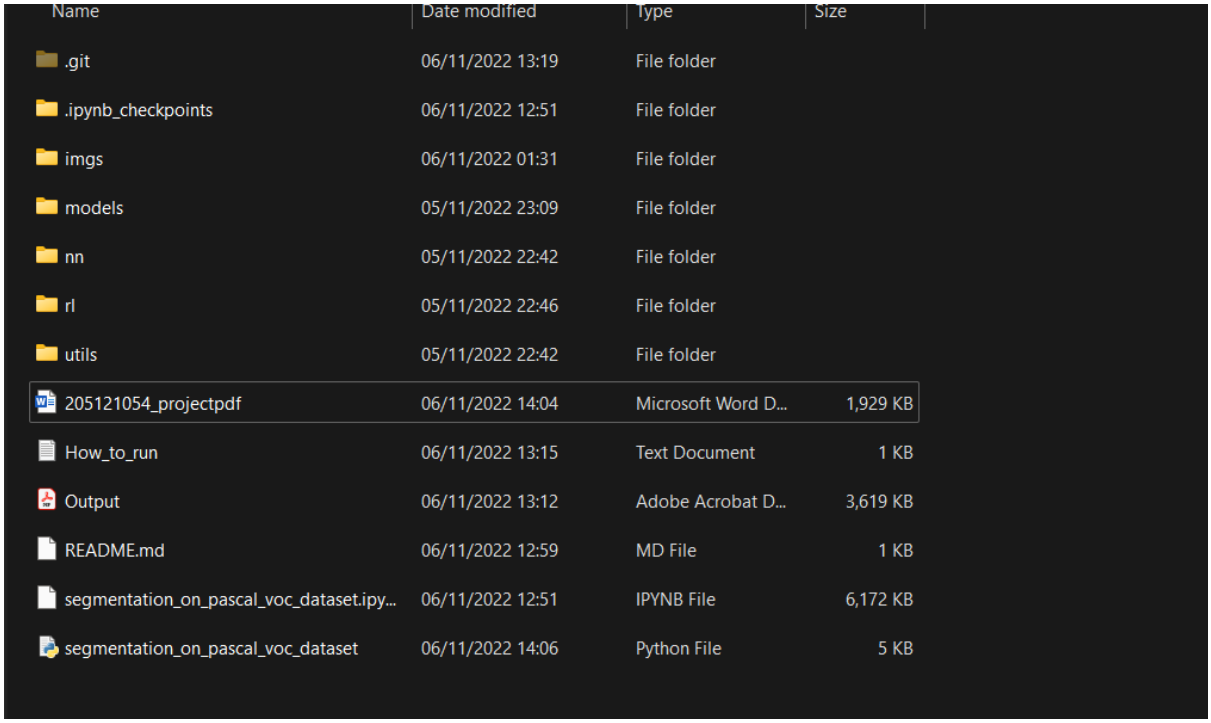


Figure 1 – Example of the encoder-decoder auxiliary search layout. Controller RNN (*bottom*) first generates connections between encoder and decoder (*top left*), and then samples locations and operations to use inside the cell (*top right*). All the cells (including auxiliary cell) share the emitted design. In this example, the controller first samples two indices (*block1* and *block3*), both of which pass through the corresponding cells, before being summed up to create *block4*. The controller then samples *block2* and *block3* that are merged into *block5*. Since *block4* was not sampled, it is concatenated with *block5* and fed into 1×1 convolution followed by the final classifier. The output of *block4* is also passed through an auxiliary cell for intermediate supervision. To emit the cell design, the controller starts by sampling the first operation applied on the cell input (*op1*), followed by sampling of two indices – *index0*, corresponding to the cell input, and *index1* of the output layer after the first operation. Two operations – *op2* and *op0* – are applied on each index, respectively, and their summation serves as the cell output.

File structure:



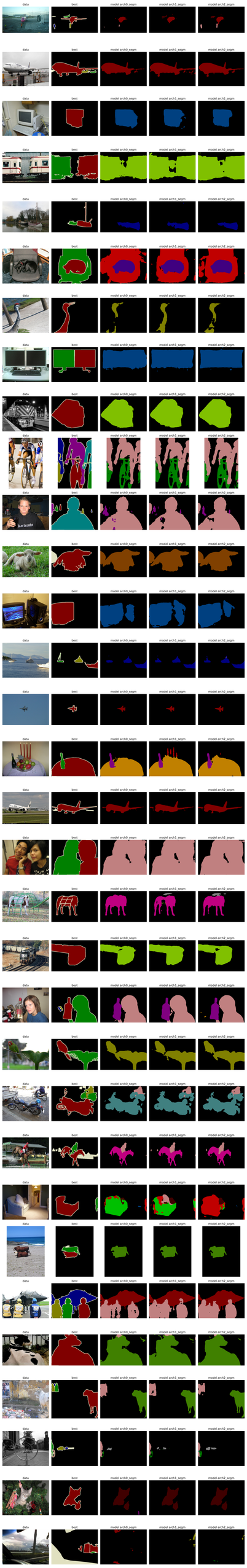
- Imgs contains PASCAL VOC dataset
- Models contains three pretrained segmentation models.
- segmentation_on_pascal_voc_dataset.py is the python file to run.
- Rest folders contain support modules.

Dataset link:

http://host.robots.ox.ac.uk/pascal/VOC/voc2008/index.html

Bibliography

- https://openaccess.thecvf.com/content_CVPR_2019/papers/Nekrasov_Fast_Neural_Architecture_Search_of_Compact_Semantic_Segmentation_Models_via_CVPR_2019_paper.pdf
- https://github.com/DrSleep/nas-segm-pytorch
- https://arxiv.org/abs/1810.10804


data
best
model arch0_segm
model arch1_segm
model arch2_segm