Adaptive and Efficient Vision Model Selection using Zero-Cost and Resource-Aware Techniques

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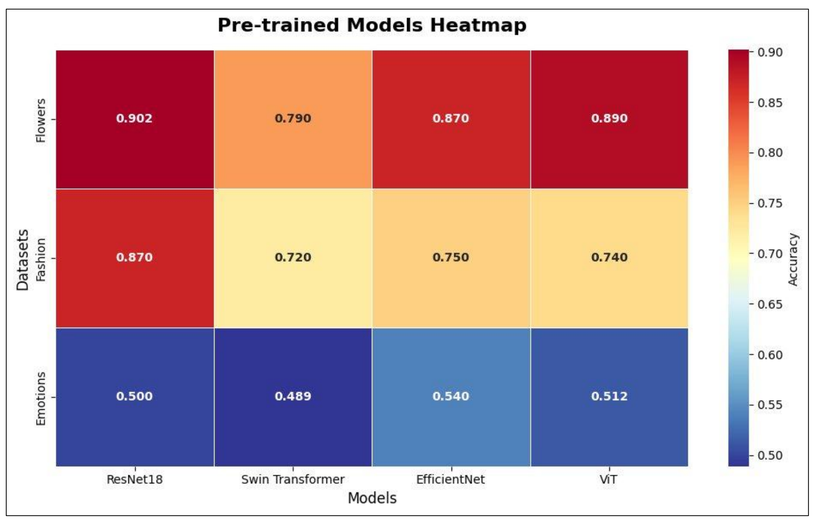
GenZs

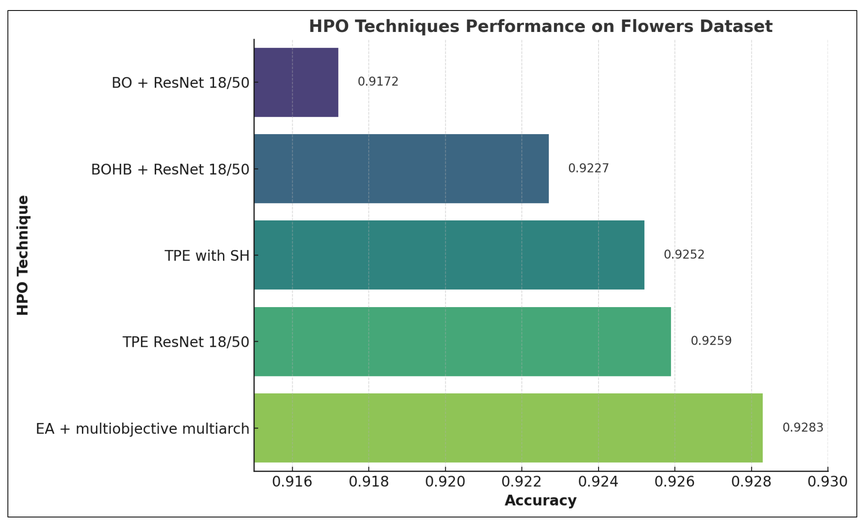
Vision Modality

Motivation

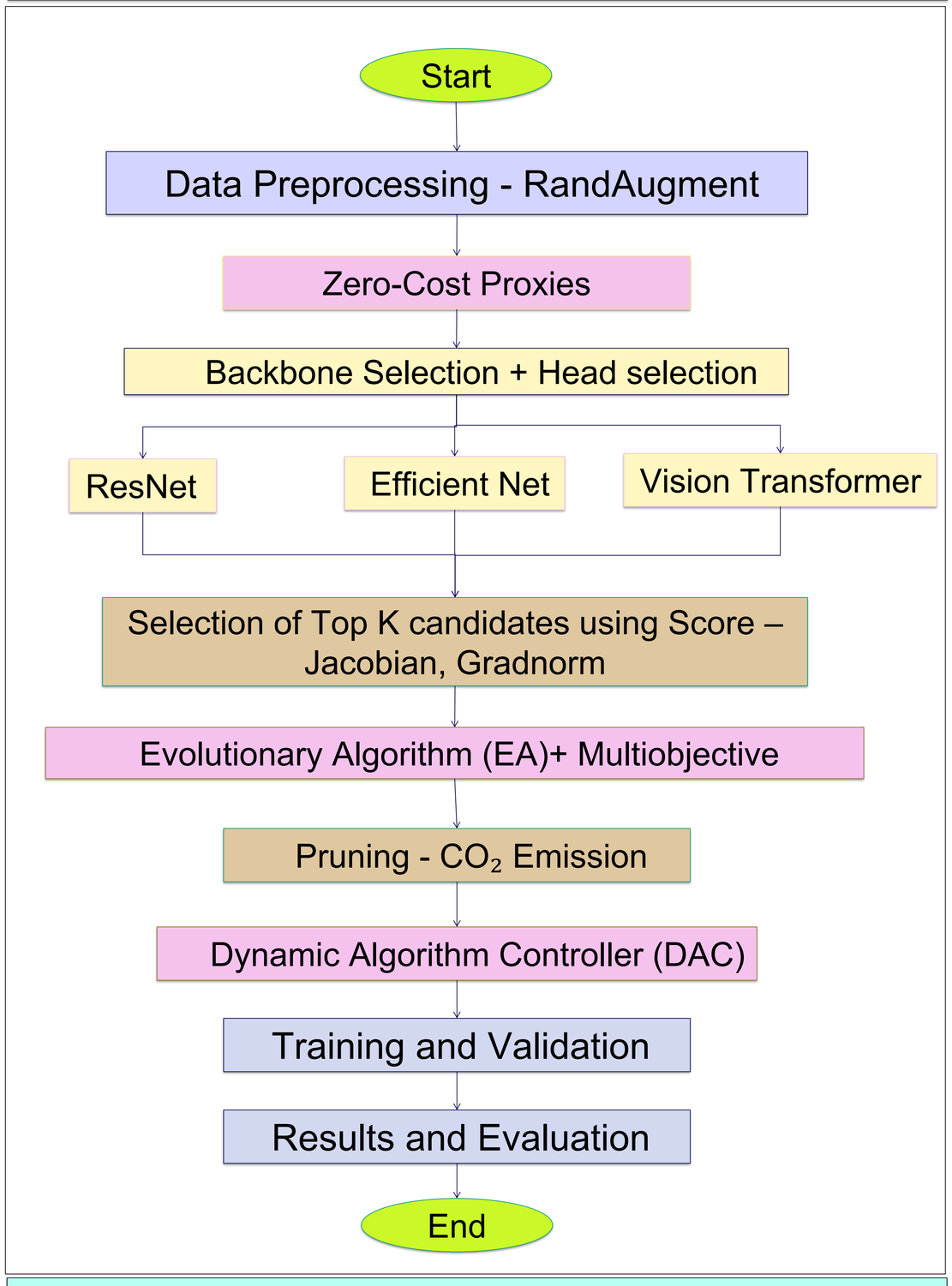
- **Data Augmentation** (RandAugment) to balance dataset classes.
- Use **zero-cost proxies** to rapidly estimate model performance.
- Apply **evolutionary search (Optuna NSG-III sampler)** over diverse vision backbones (**ResNet, EfficientNet, Vision Transformer**)
- Select the best candidates using **pareto fronts**.
- Guide HPO through **CO2 aware strategies** for resource efficiency.
- Improve training dynamically with **DAC**- Dynamic Algorithm Configuration on **Learning Rate** and **Optimizer.**

Model Selection Strategy





Model Architecture



- Week 1
- Week 2
- Week 3
- Week 4
- Week 5
- Week 6
- Week 7
- Week 8
- Week 9
- Week 10
- Bonus
- Literature

Resources Used

For Train and Development:
- GPUP100
- T4 - GPU
- CPUs
- 700 hours

GPU Hours:
- Test Predictions : 3 hours

Workforce:
- 3 Full weeks

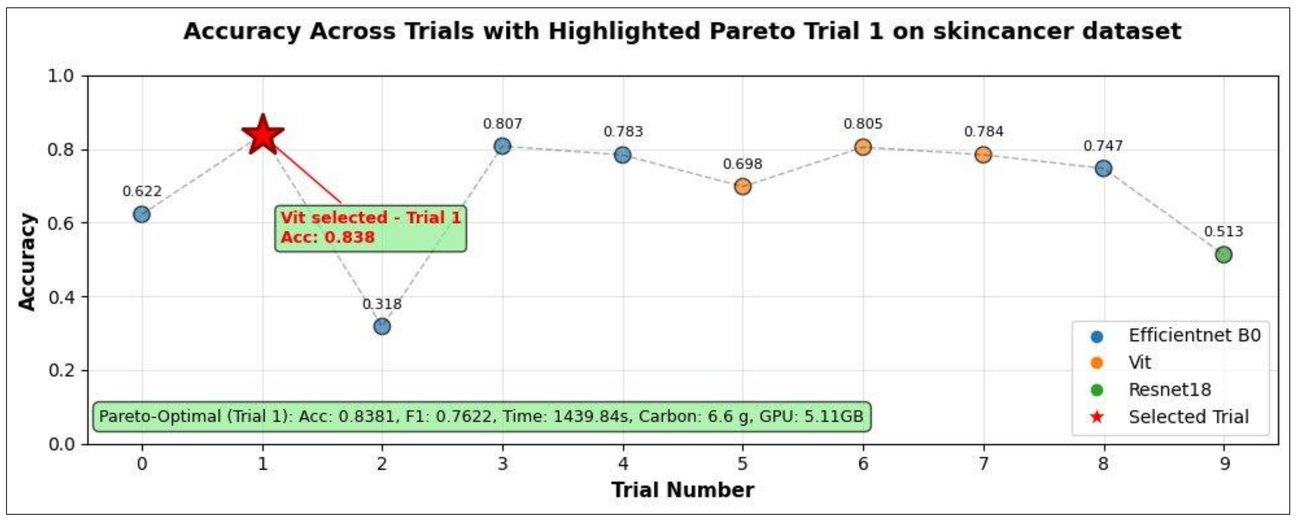
Number of queries for test score generation: 1

Reference

- Abdelfattah, Mohamed & Mehrotra, Abhinav & Dudziak, Łukasz & Lane, Nicholas. (2021). Zero-Cost Proxies for Lightweight NAS.
- Benoit Courty, 'mlco2/codecarbon: v2.4.1'. Zenodo, May 10, 2024.

Results

Model Performance Across Seeds (10 Trials each)					
Dataset	**Metric**	**Baseline Accuracy**	**Seed 6**	**Seed 42**	**Seed 92**
flowers	Test Accuracy	0.55	0.944	0.933	0.97
	F1 Score		0.938	0.931	0.967
emotions	Test Accuracy	0.41	0.684	0.646	0.677
	F1 Score		0.668	0.636	0.662
fashion	Test Accuracy	0.88	0.945	0.933	0.938
	F1 Score		0.945	0.933	0.937
skincancer	Test Accuracy	0.71	N/A	0.86	N/A
	F1 Score		N/A	0.79	N/A

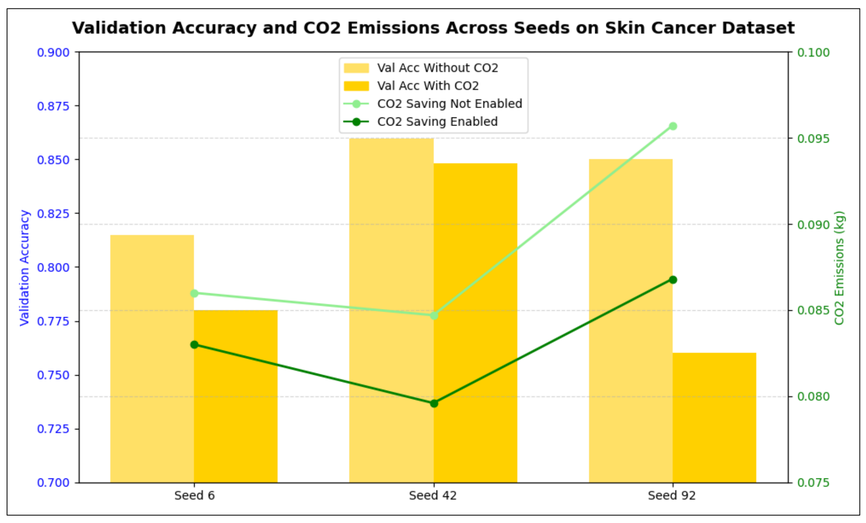


Limitations

1. Estimated Carbon Costs for each architecture are heuristic based, runtime variability might prune trials prematurely.
2. The use of custom heads may introduce misalignment with proxy assumptions.

Contributions

Manasi	Resnet18, Efficient net B0, Vision Transformer, DAC, Poster Design, Result Plots.
Reeya	Zero Proxies, Multi-Objective, Optuna with NSG-III Sampler, Code commenting, readme.md.
Chandrika	CO2 Strategies and Rand Augment, Code integration and Structuring, Result Plots.



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