

CROSSPOINT

A PYTORCH REIMPLEMENTATION OF THE CROSSPOINT PAPER
WITH ADVANCED INTEGRATIONS.



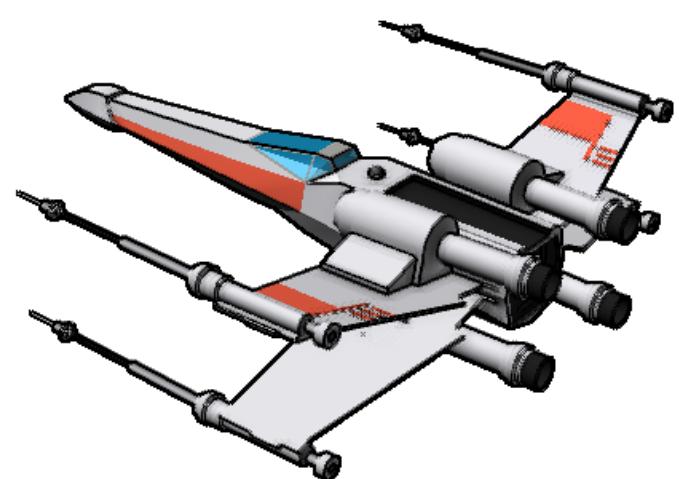
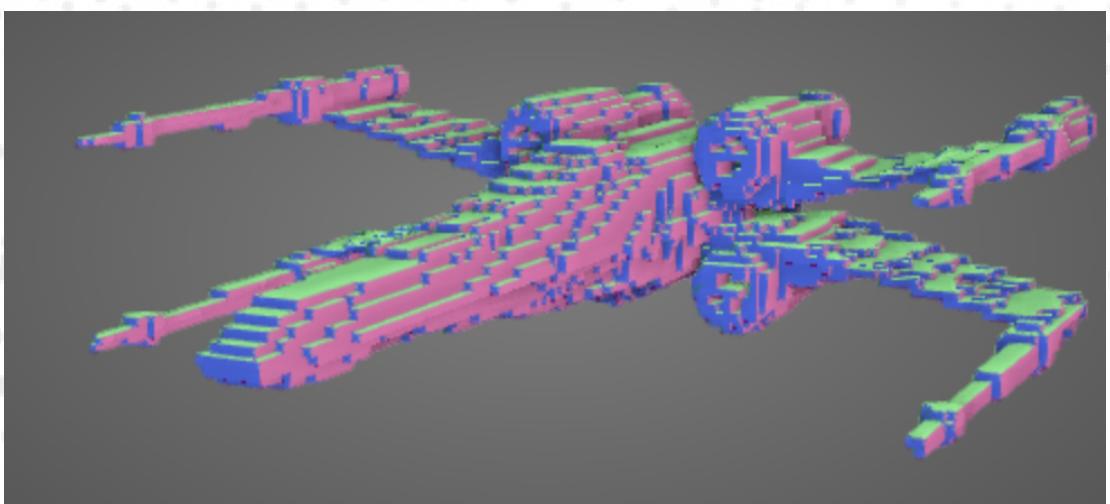
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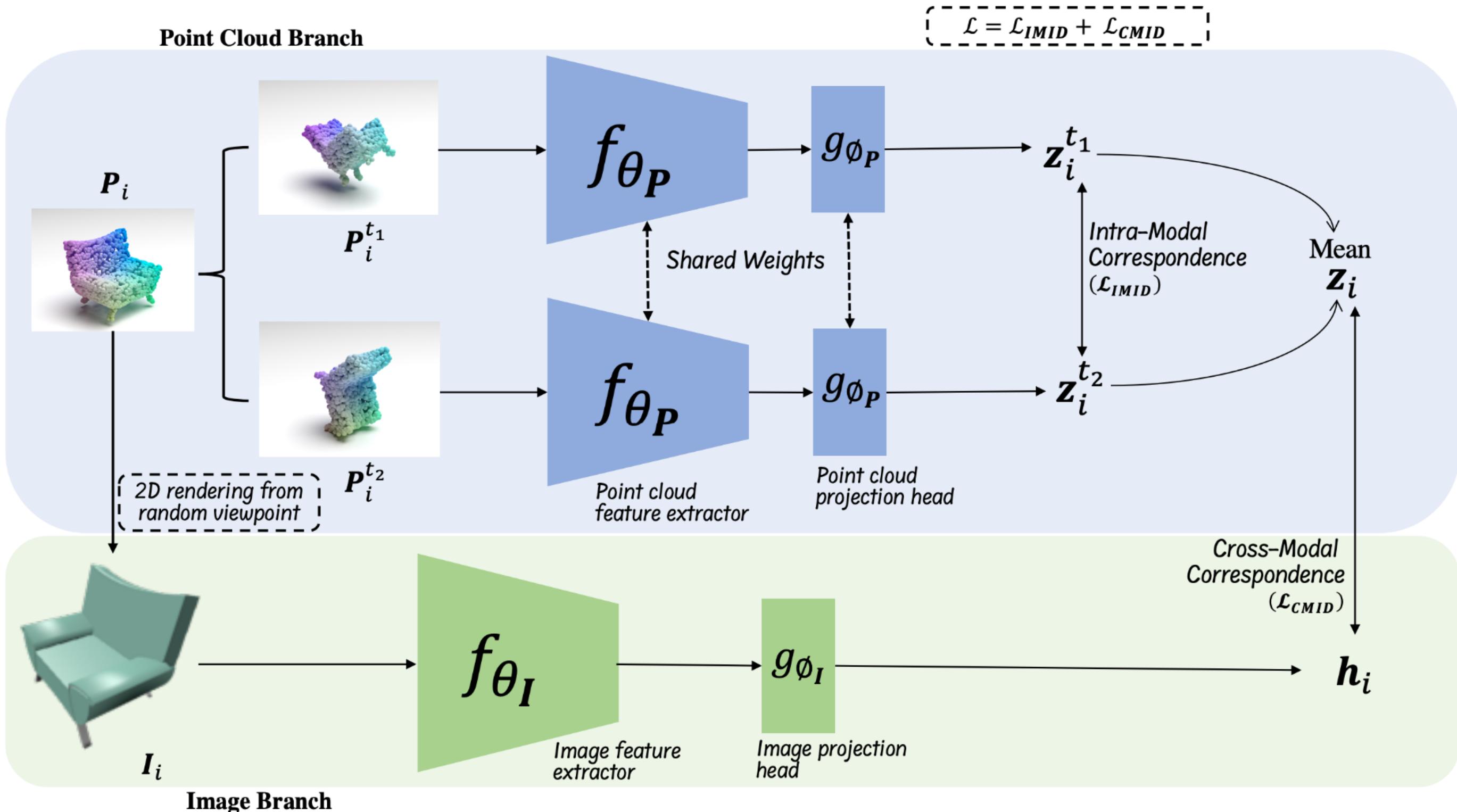


CROSSPOINT - PAPER

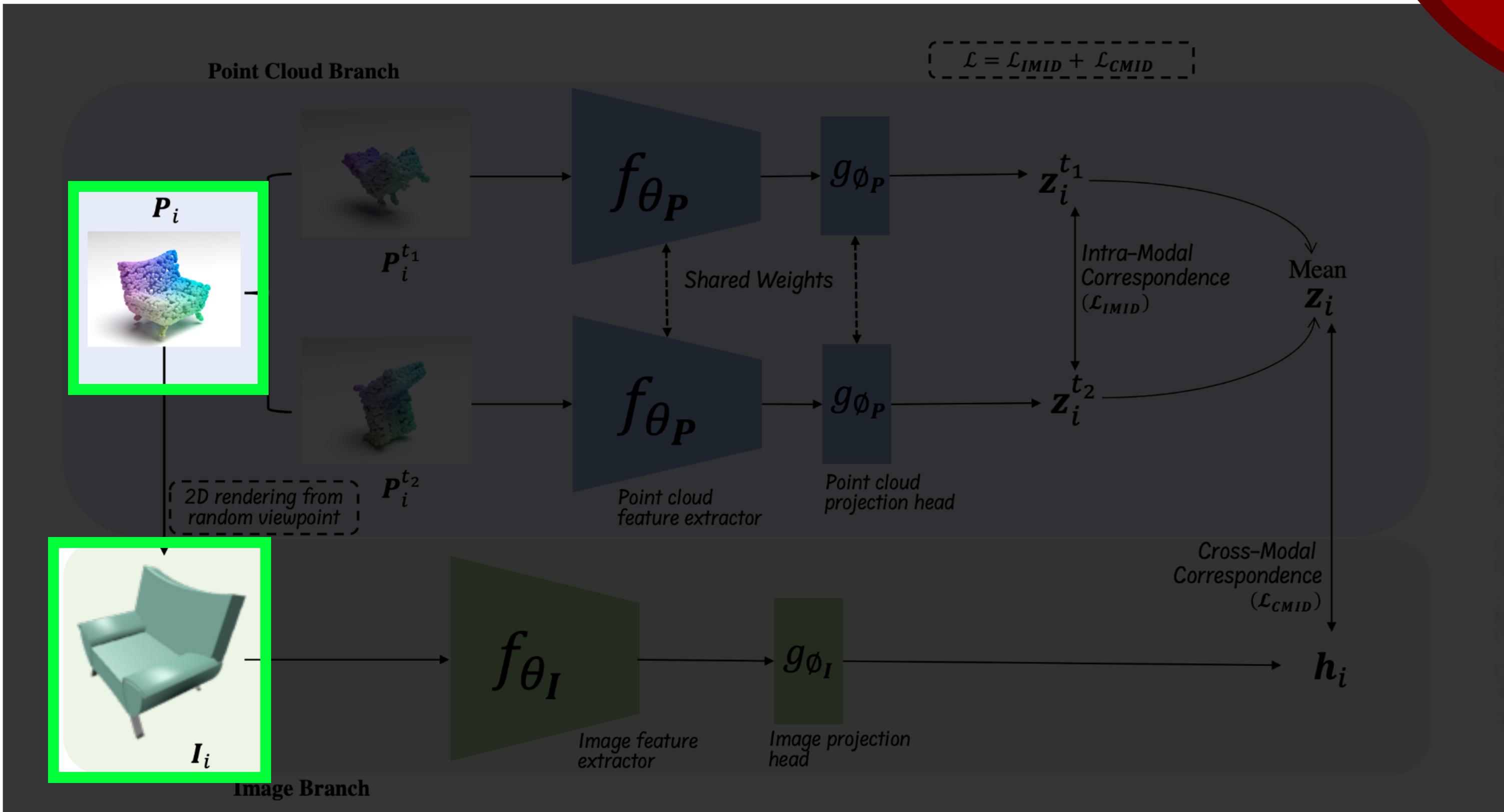
AS HUMAN WE USE 2D CONTEXT
TO RECOGNIZE 3D OBJECT
IN THE REAL WORLD.



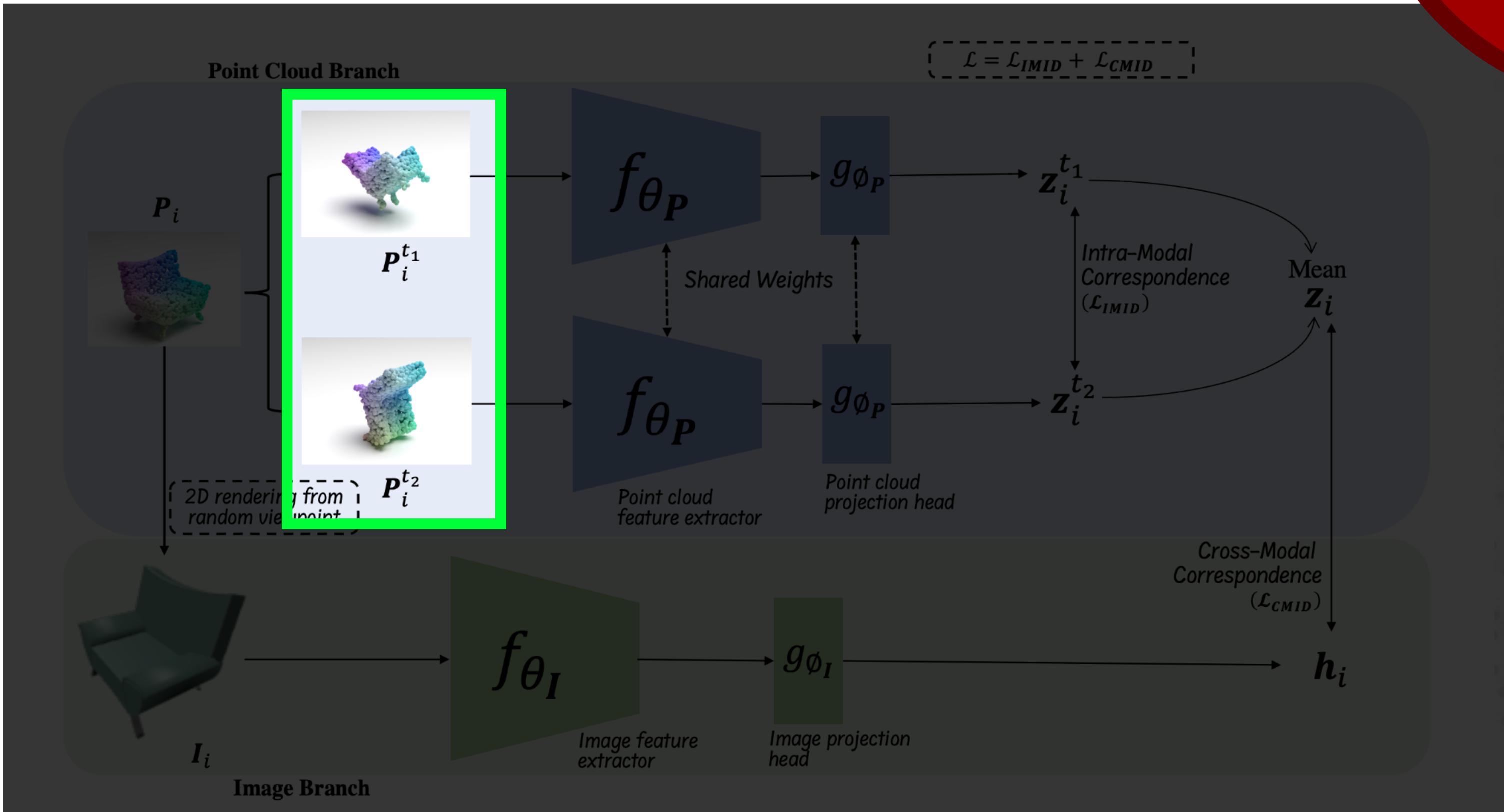
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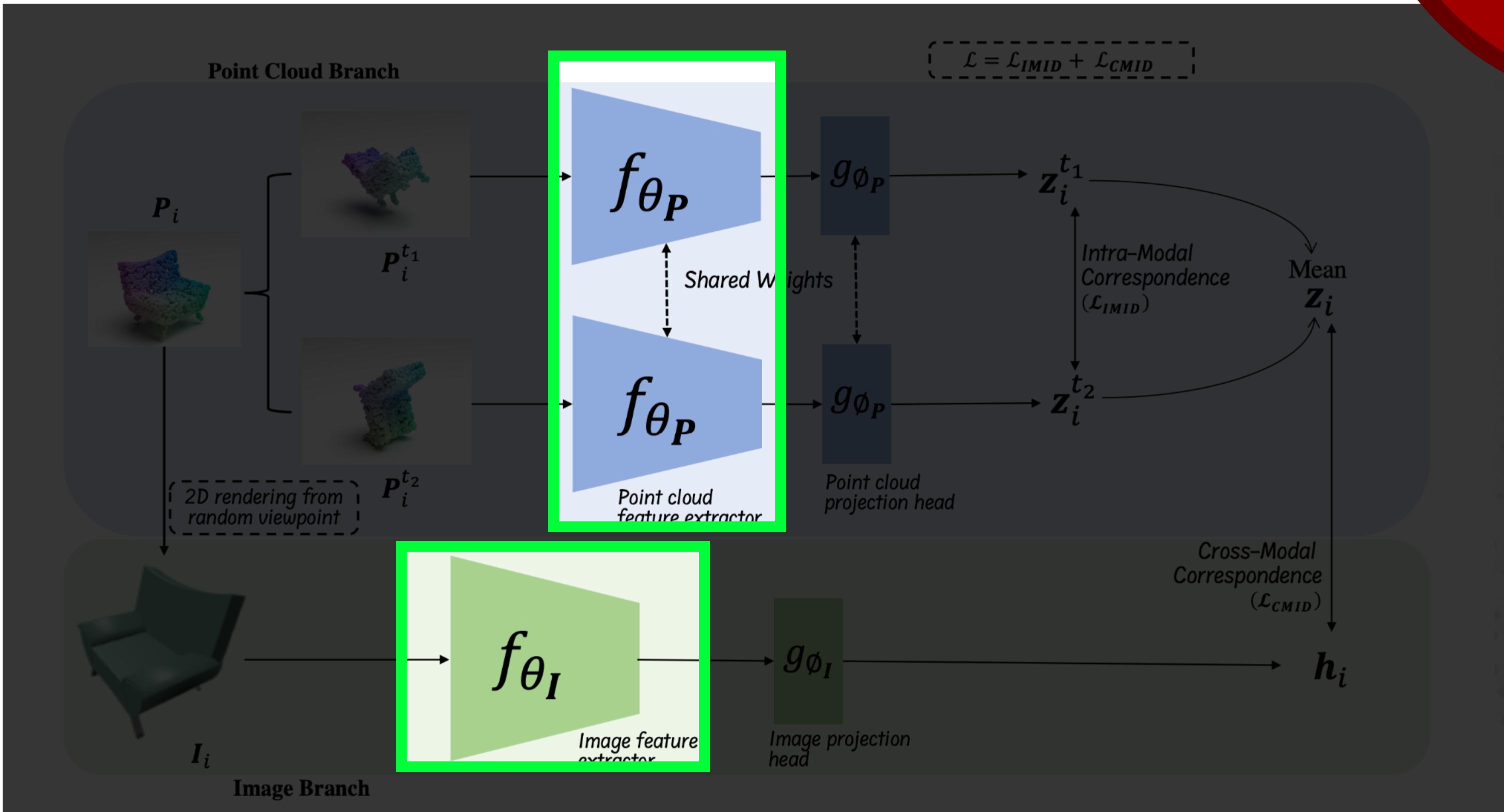
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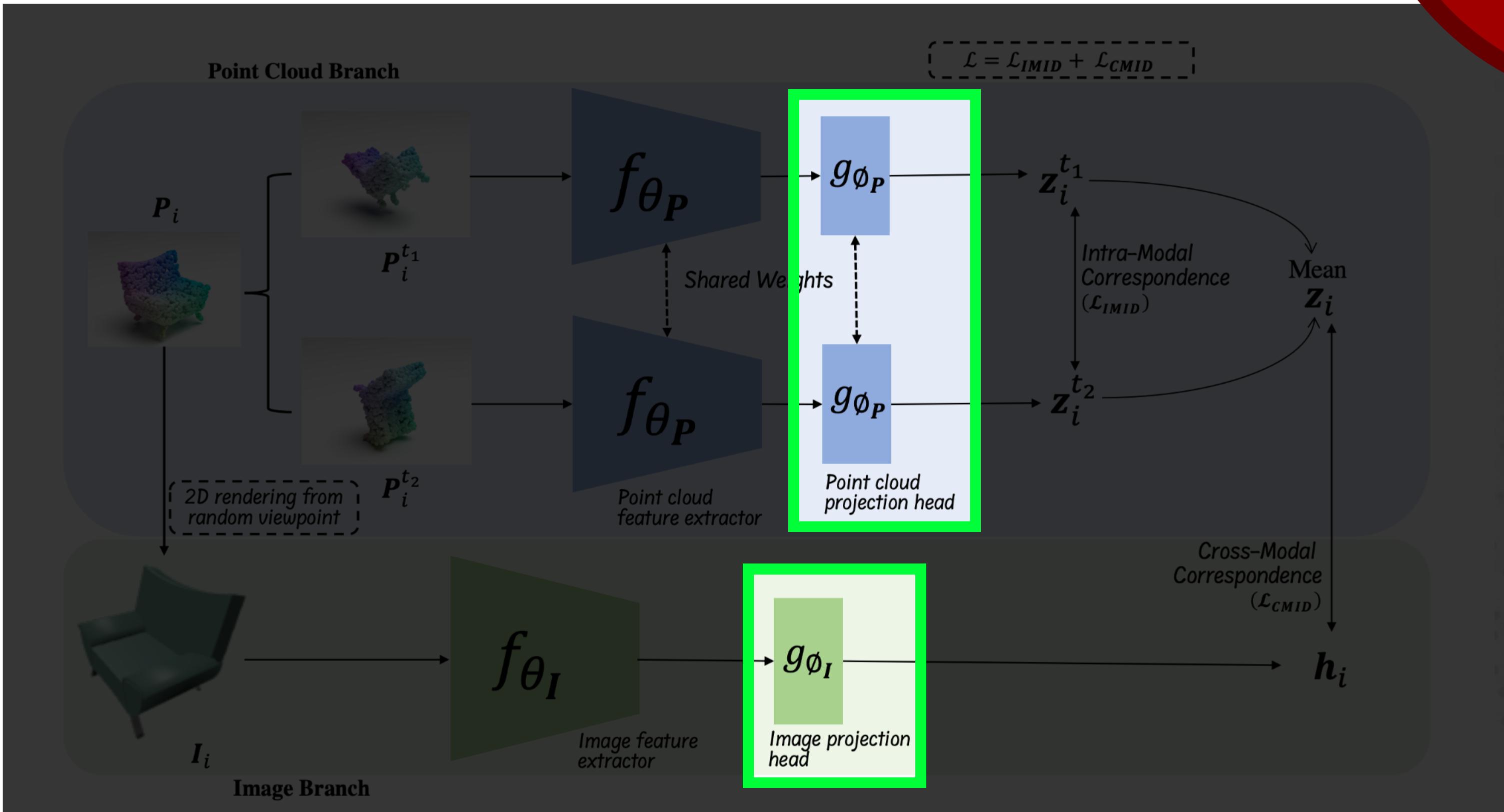
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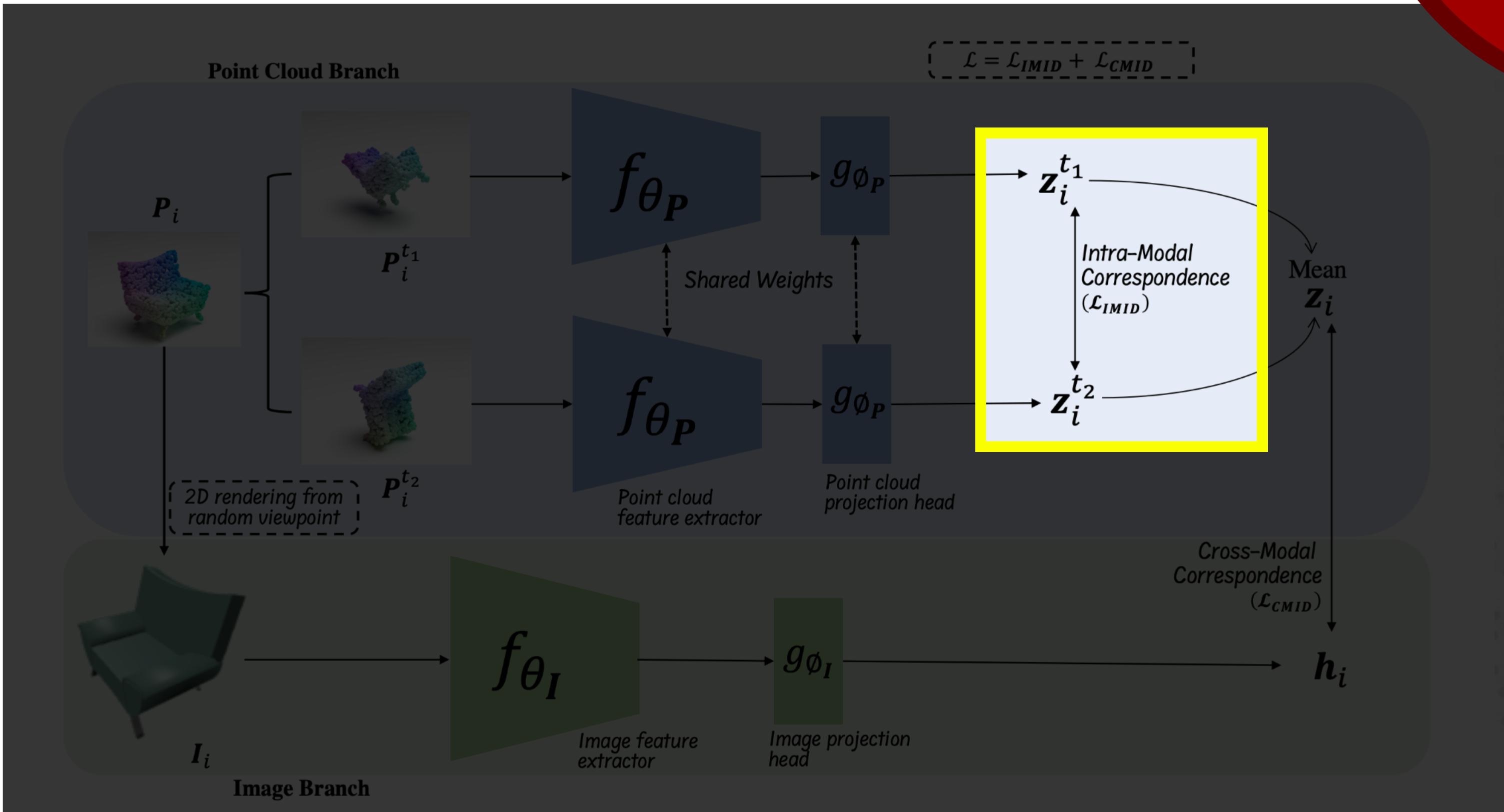
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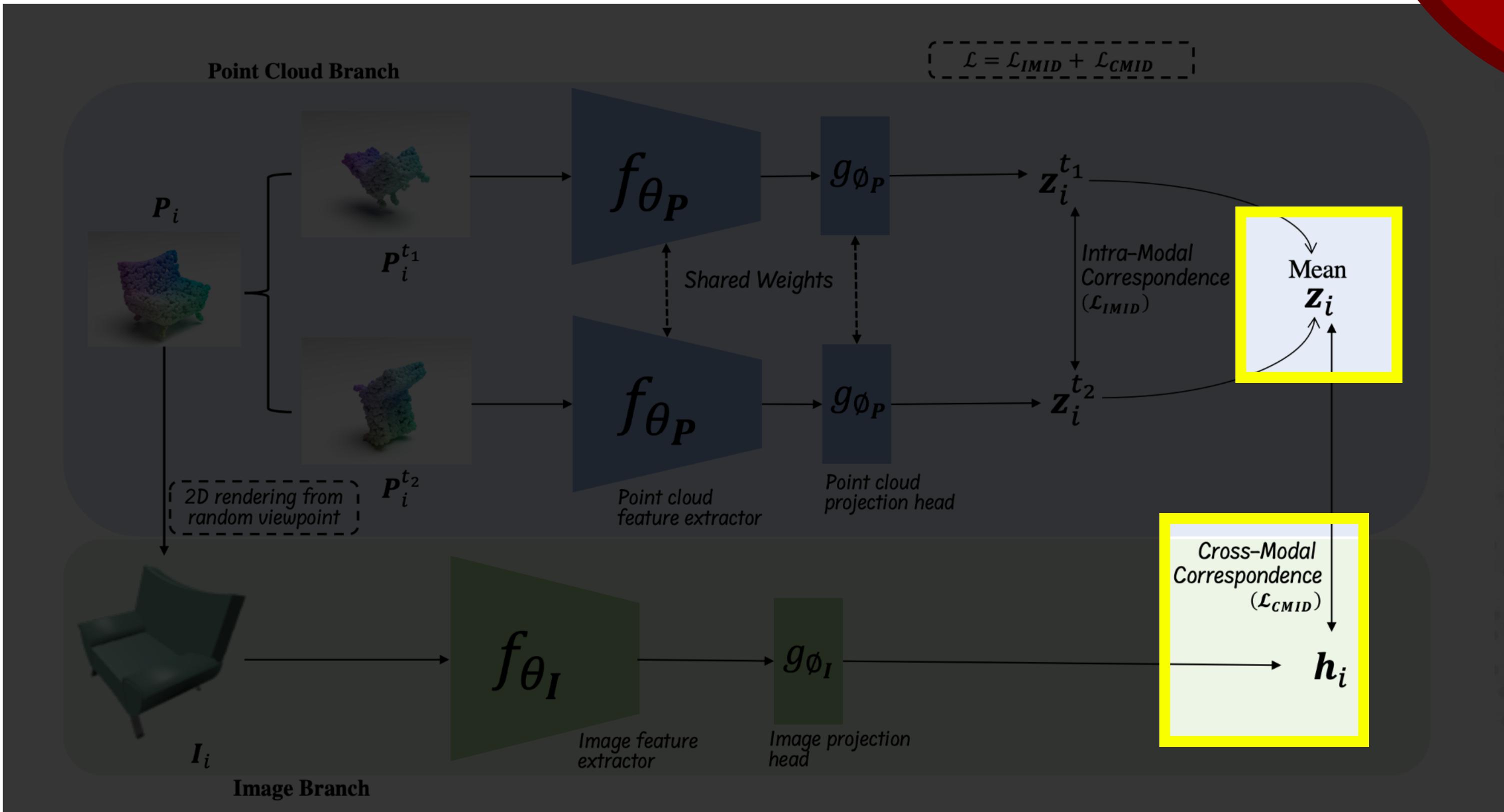
CROSSPOINT - PAPER



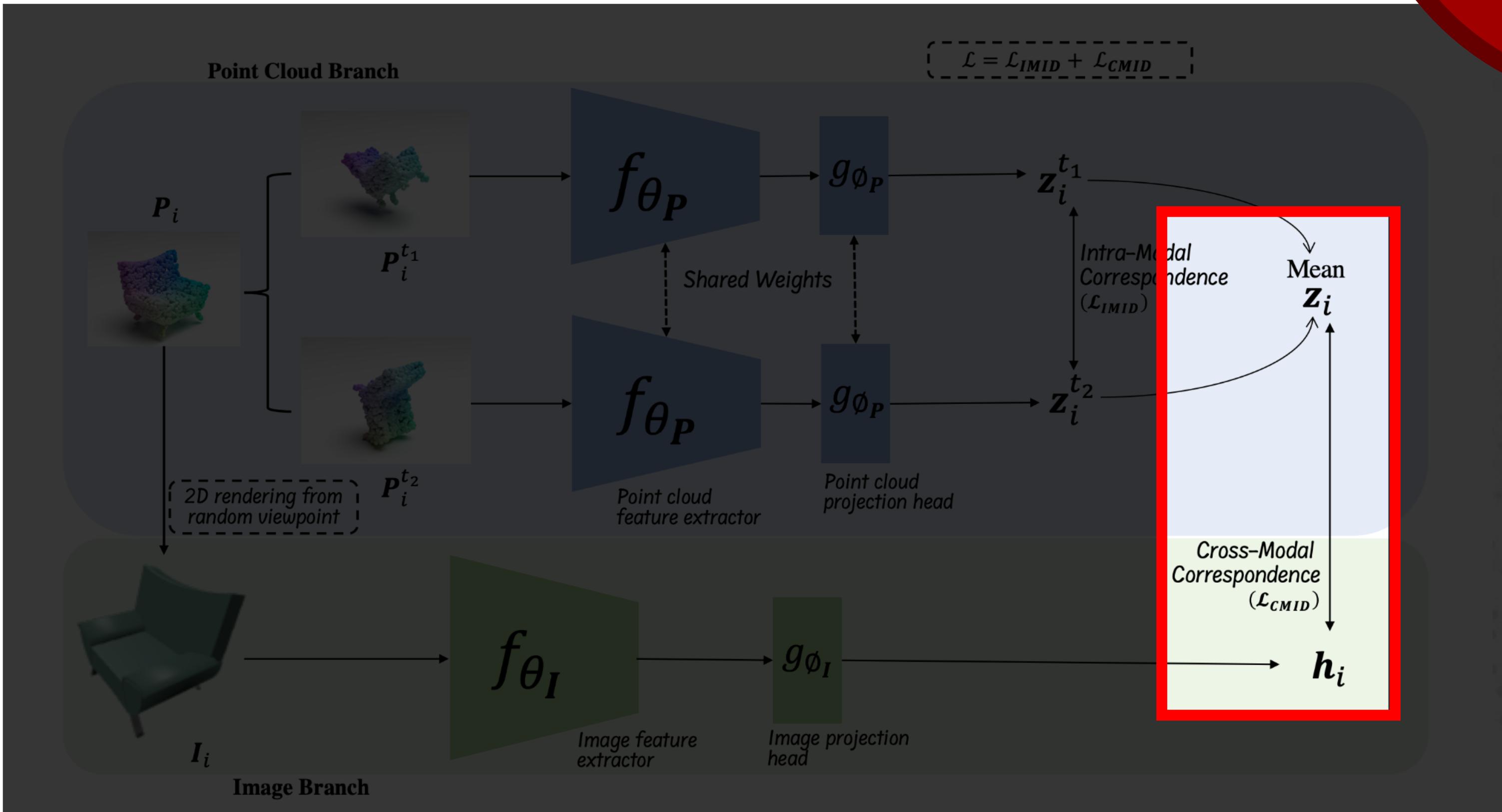
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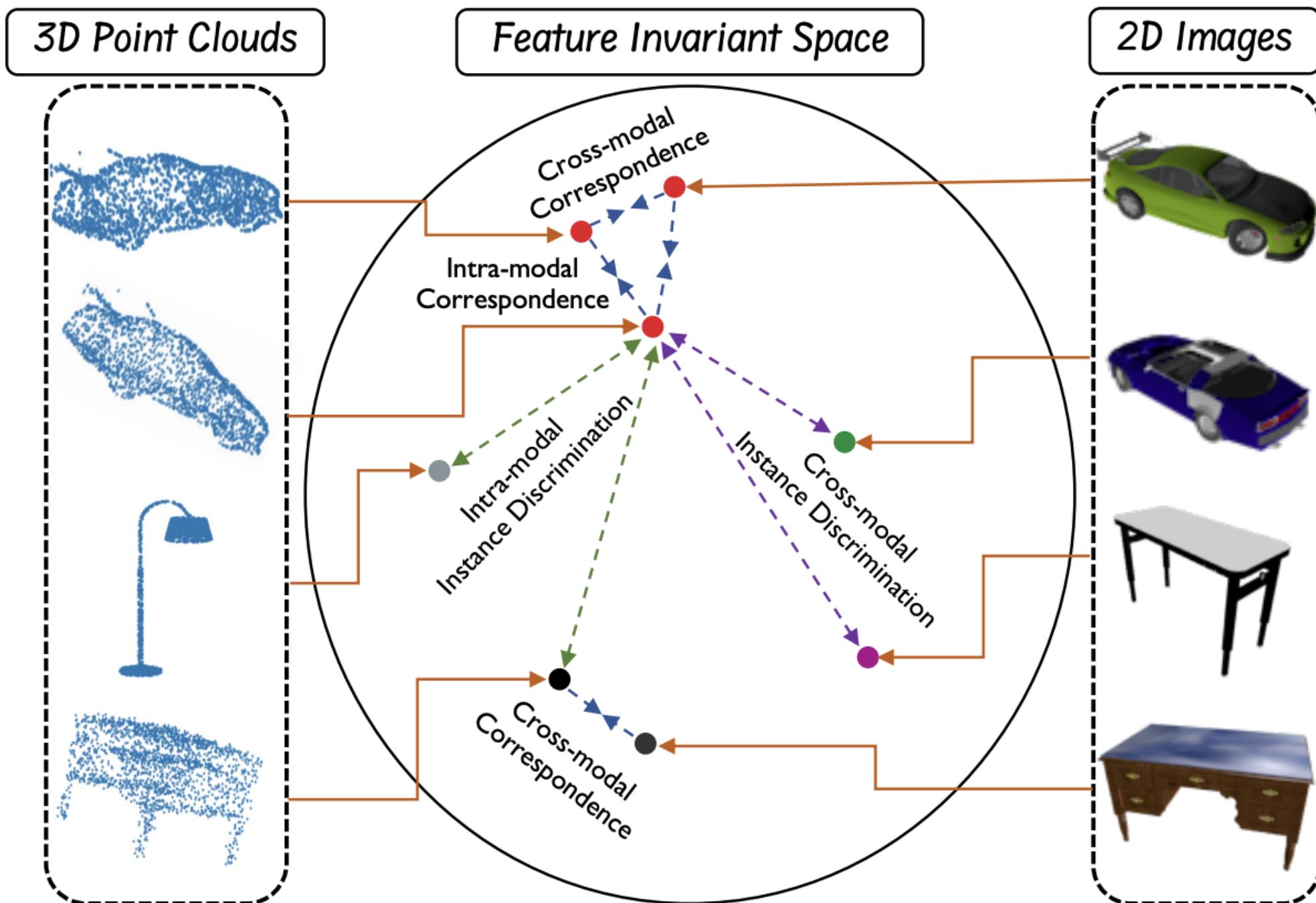
CROSSPOINT - PAPER



CROSSPOINT - PAPER

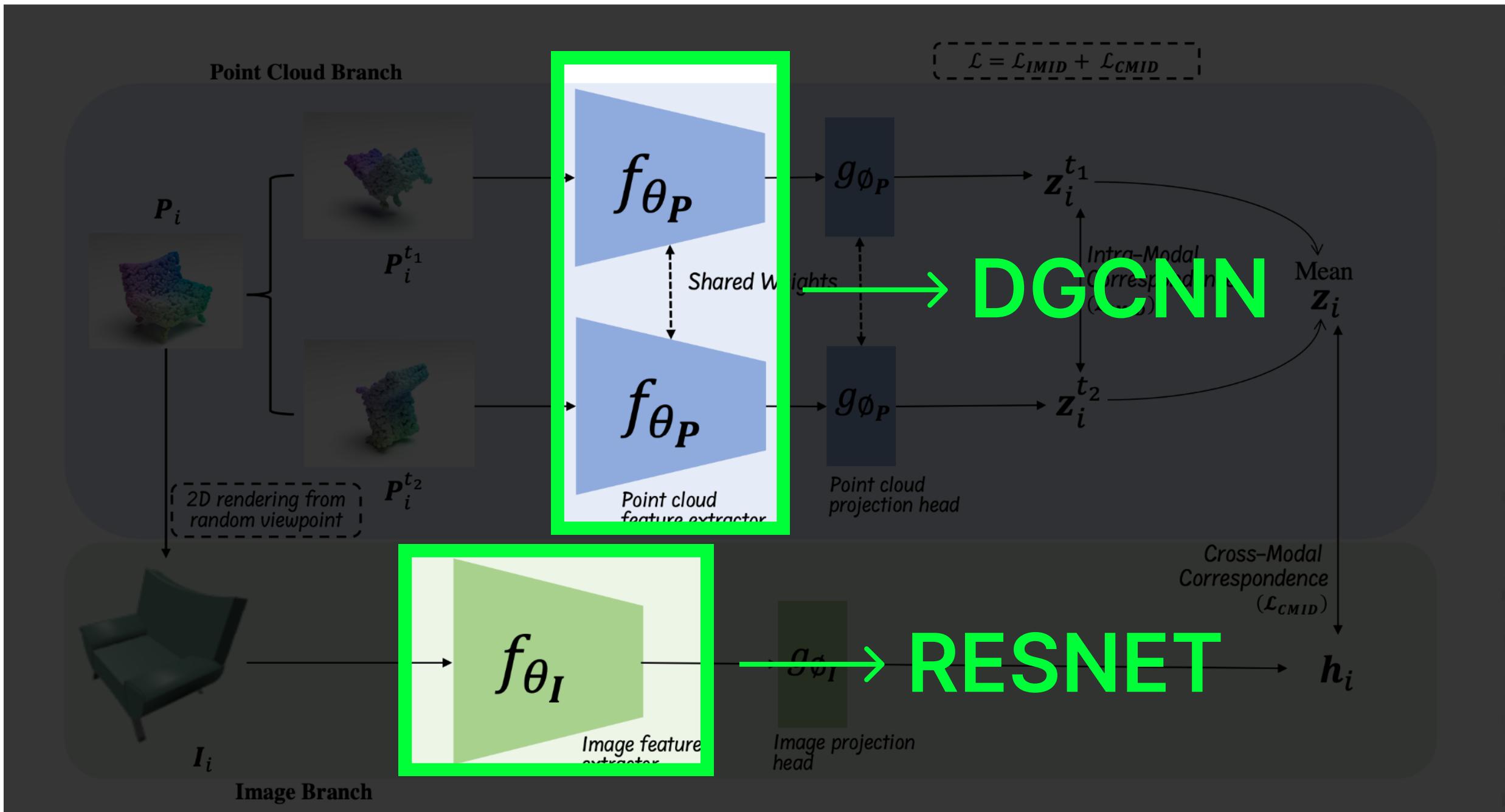


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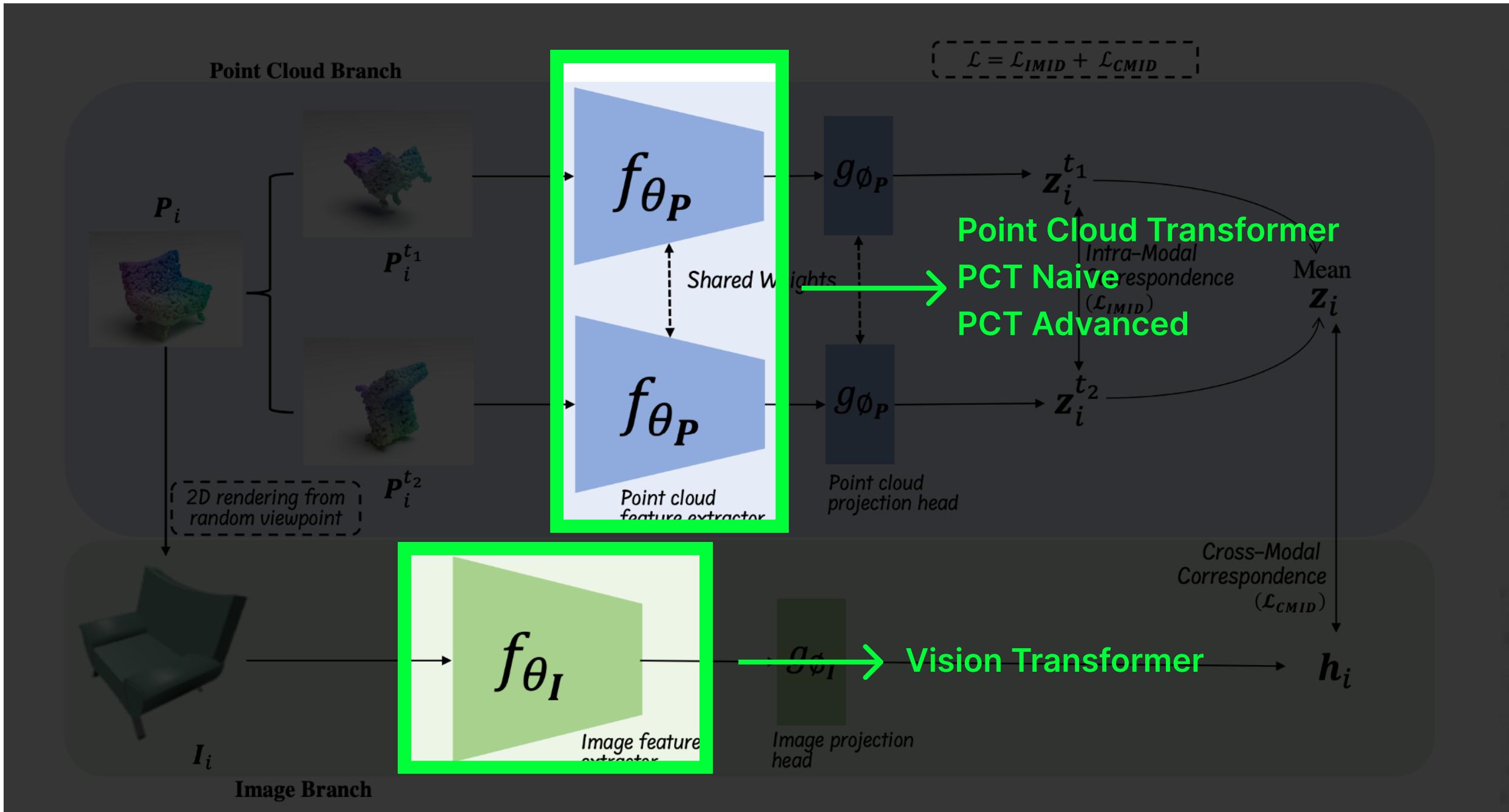
CROSSPOINT

MODELS



OUR WORK

Hybrid and full transformer-based models



OUR WORK

LIGHTNING REIMPLEMENTATION

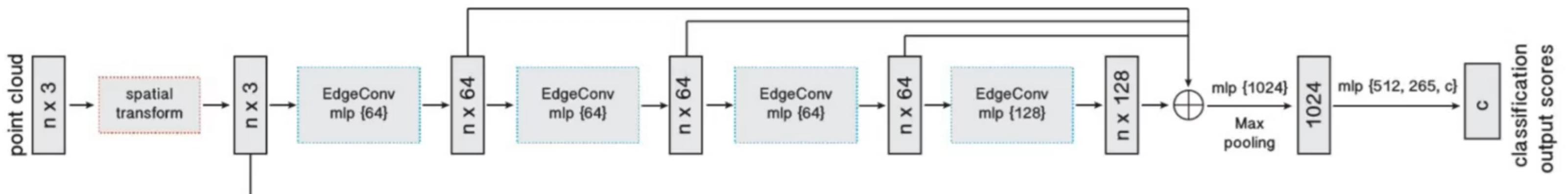


Research framework:

- modular
- manages the devices

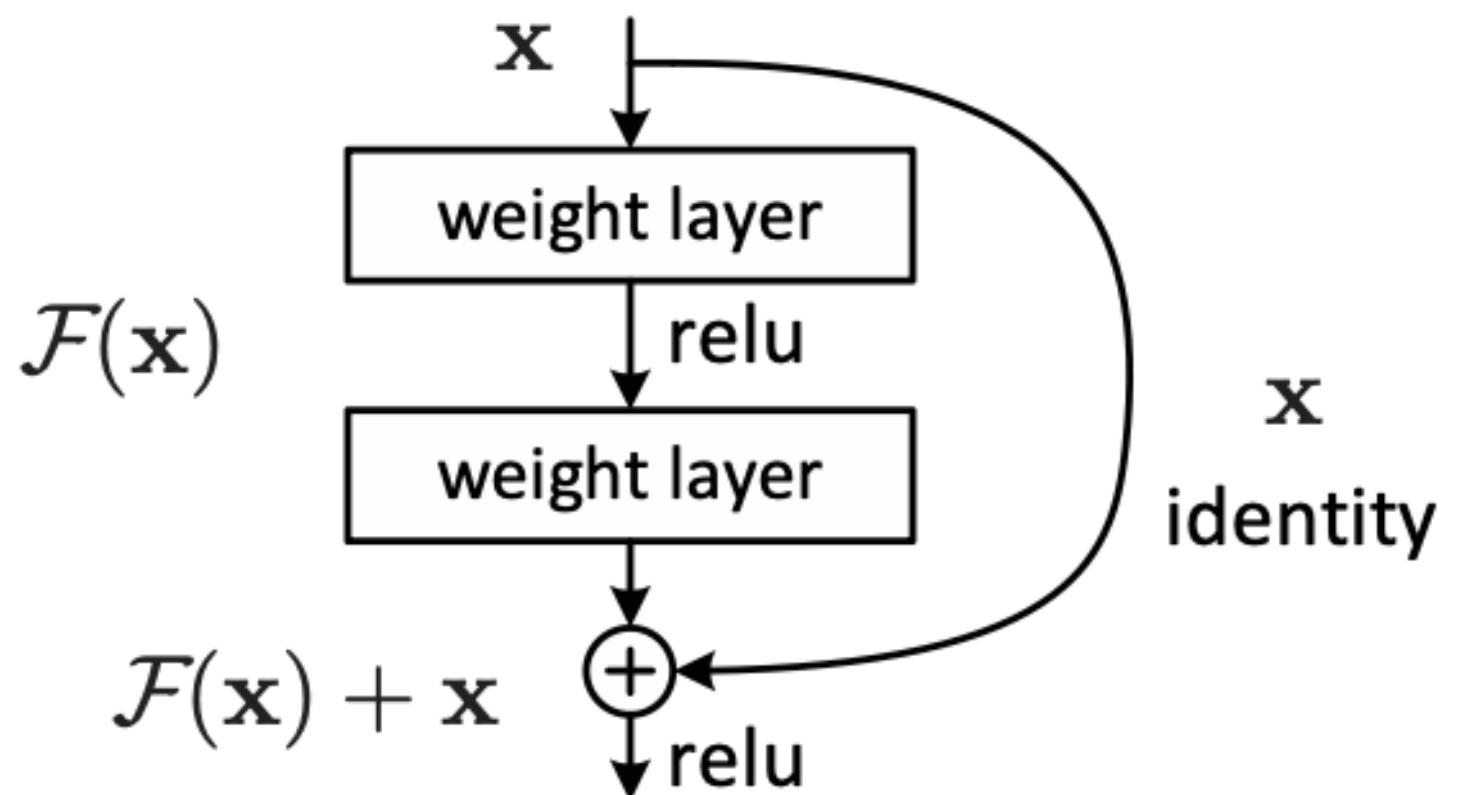
OUR WORK

DGCNN



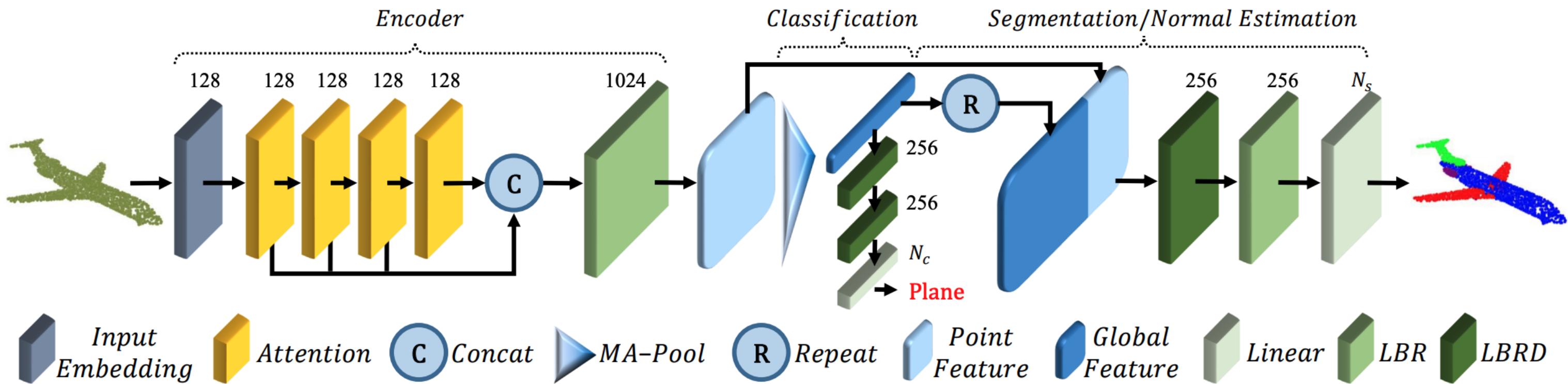
OUR WORK

RESNET



OUR WORK

Point Cloud Transformer **NAIVE** (*Basic Self-attention Block*)



OUR WORK

Point Cloud Transformer **ADVANCED** (Offset-attention Block)

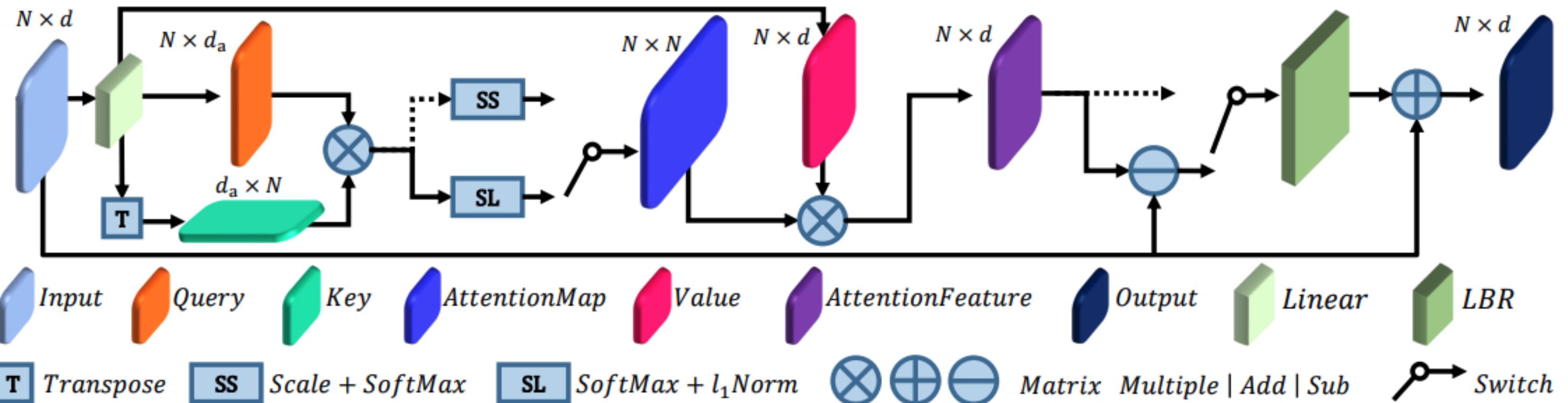
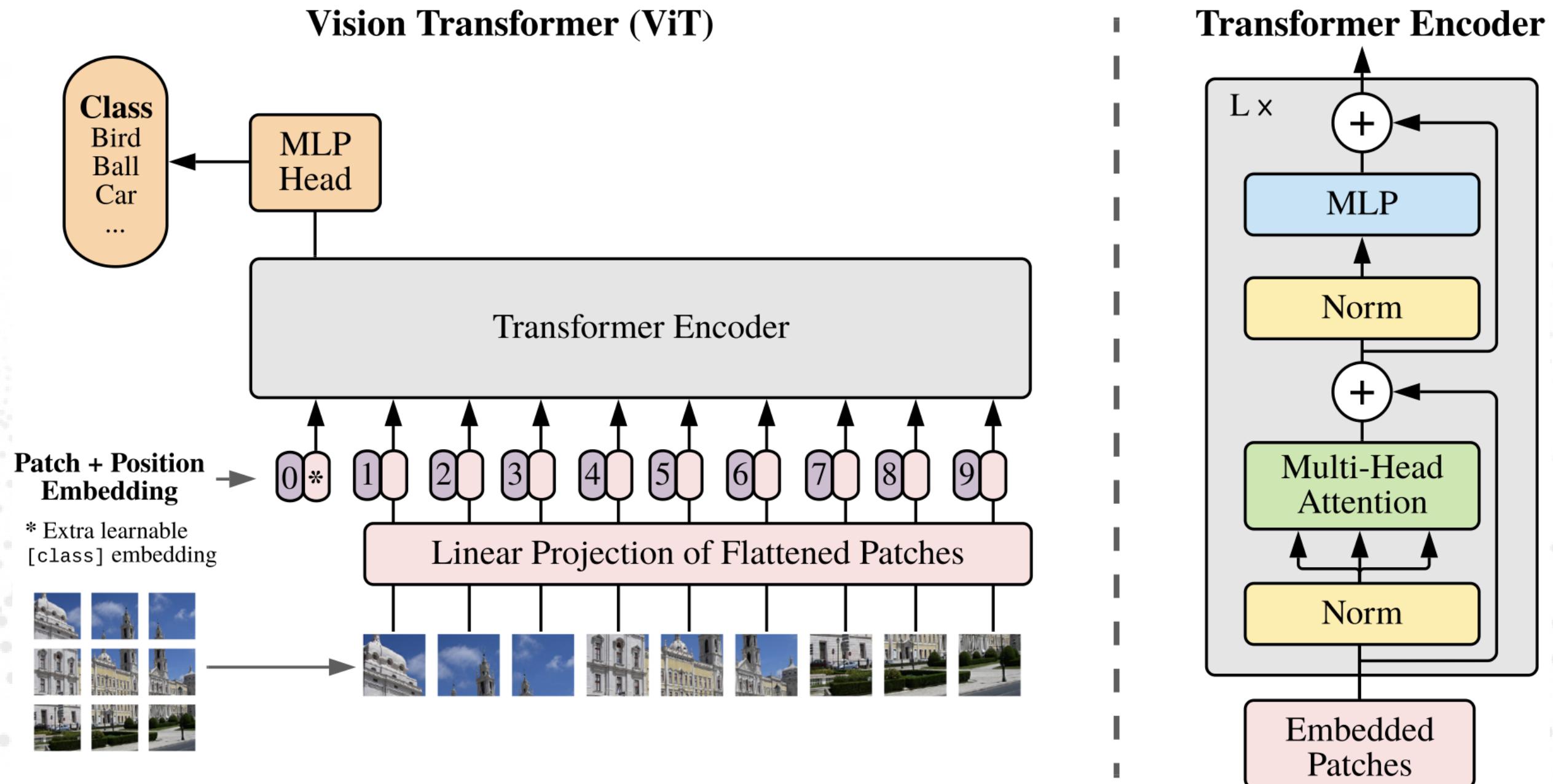


Figure 3. Architecture of Offset-Attention. Numbers above tensors are numbers of dimensions N and feature channels D/D_a , with switches showing alternatives of Self-Attention or Offset-Attention: dotted lines indicate Self-Attention branches.

OUR WORK

Vision Transformer



EXPERIMENTS

6 TRAININGS

POINT CLOUD

PCT Naive

PCT Naive

IMAGES

Resnet

Vit

PCT Advanced

PCT Advanced

Resnet

Vit

DGCNN

DGCNN

Resnet

Vit



DATASETS

SHAPENET - Training Set

Original Set

S H A P E N E T

13 Object Categories

43K Images

Used Set

5 Object Categories

- Display*
- Cabinet*
- Telephone*
- Watercraft*
- Airplane*

DATASETS

Validation and test Set

MODELNET 40 - Synthetic data



PRINCETON
MODELNET

40 Object Categories

12K Objects

SCANOBJECT - Real world data

15 Object Categories

2.8K Images



EXPERIMENTS

Training configuration

5 Object Categories

20 Epochs

Cos Annealing LR

Adam Optimizer

EXPERIMENTS

Parameters

POINT CLOUD	IMAGES	PARAMETERS
PCT Naive	Resnet	<i>Trainable: 27.7M Non Trainable: 0</i>
PCT Naive		<i>Trainable: 3.7M Non Trainable: 304M</i>
PCT Advanced	Resnet	<i>Trainable: 29.1M Non Trainable: 0</i>
PCT Advanced		<i>Trainable: 5.1M Non Trainable: 304M</i>
DGCNN	Resnet	<i>Trainable: 27.7M Non Trainable: 0</i>
DGCNN		<i>Trainable: 3.6M Non Trainable: 304M</i>

EXPERIMENTS

Hardware & Software

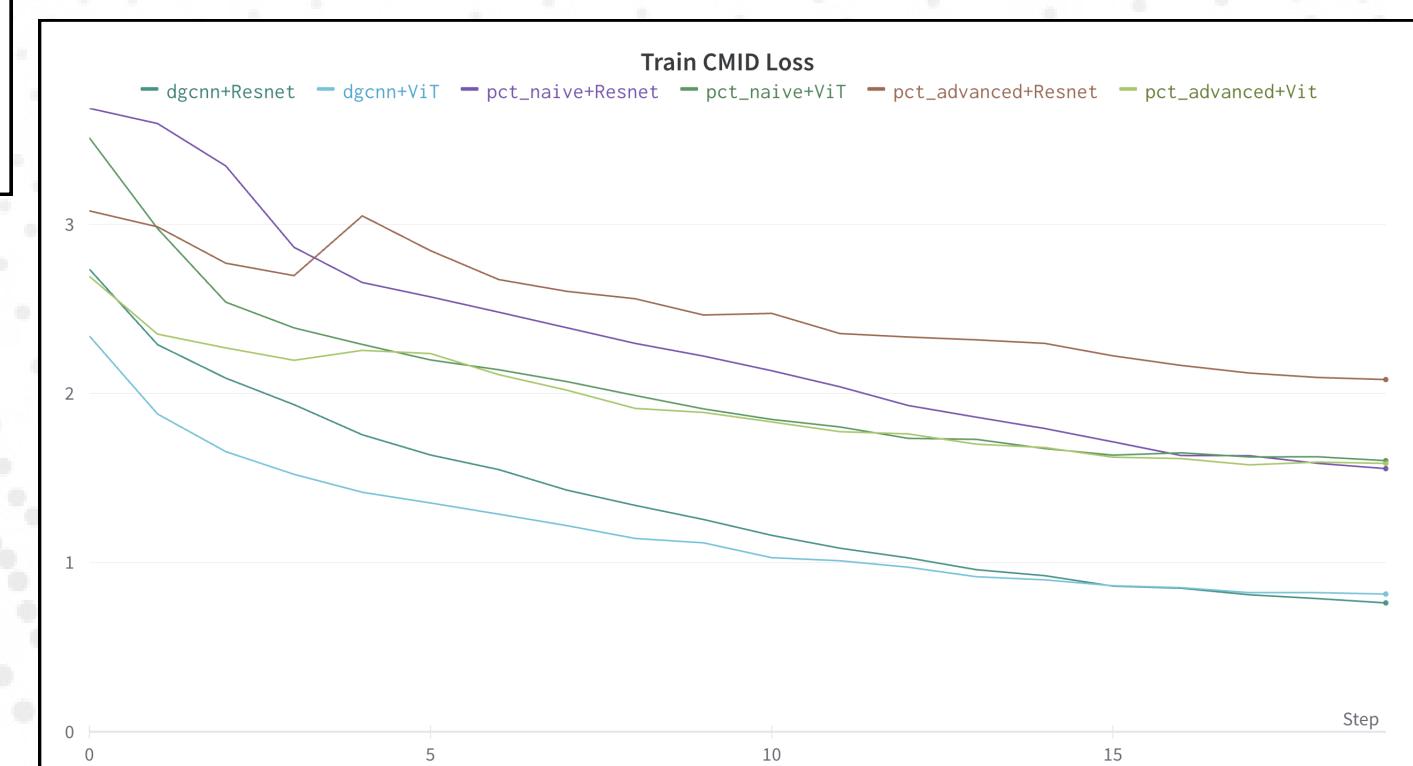
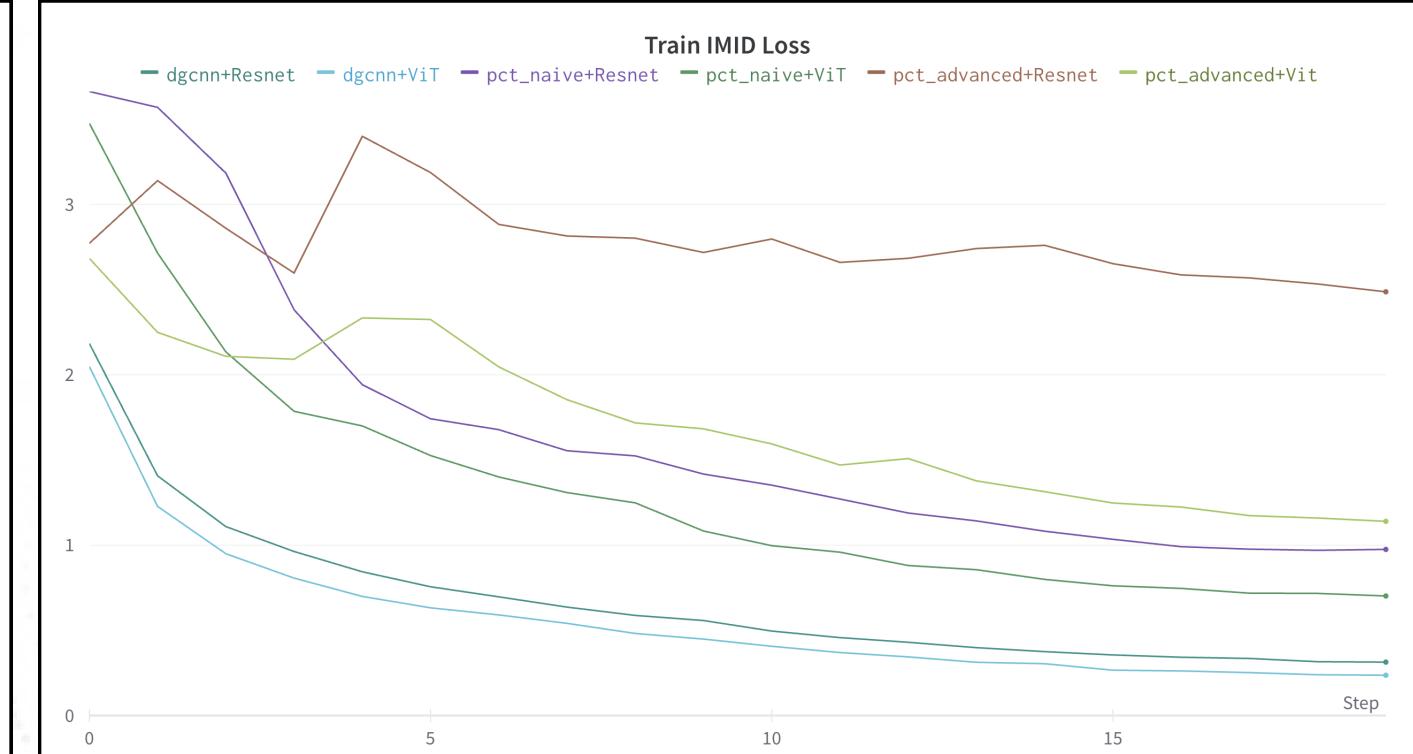
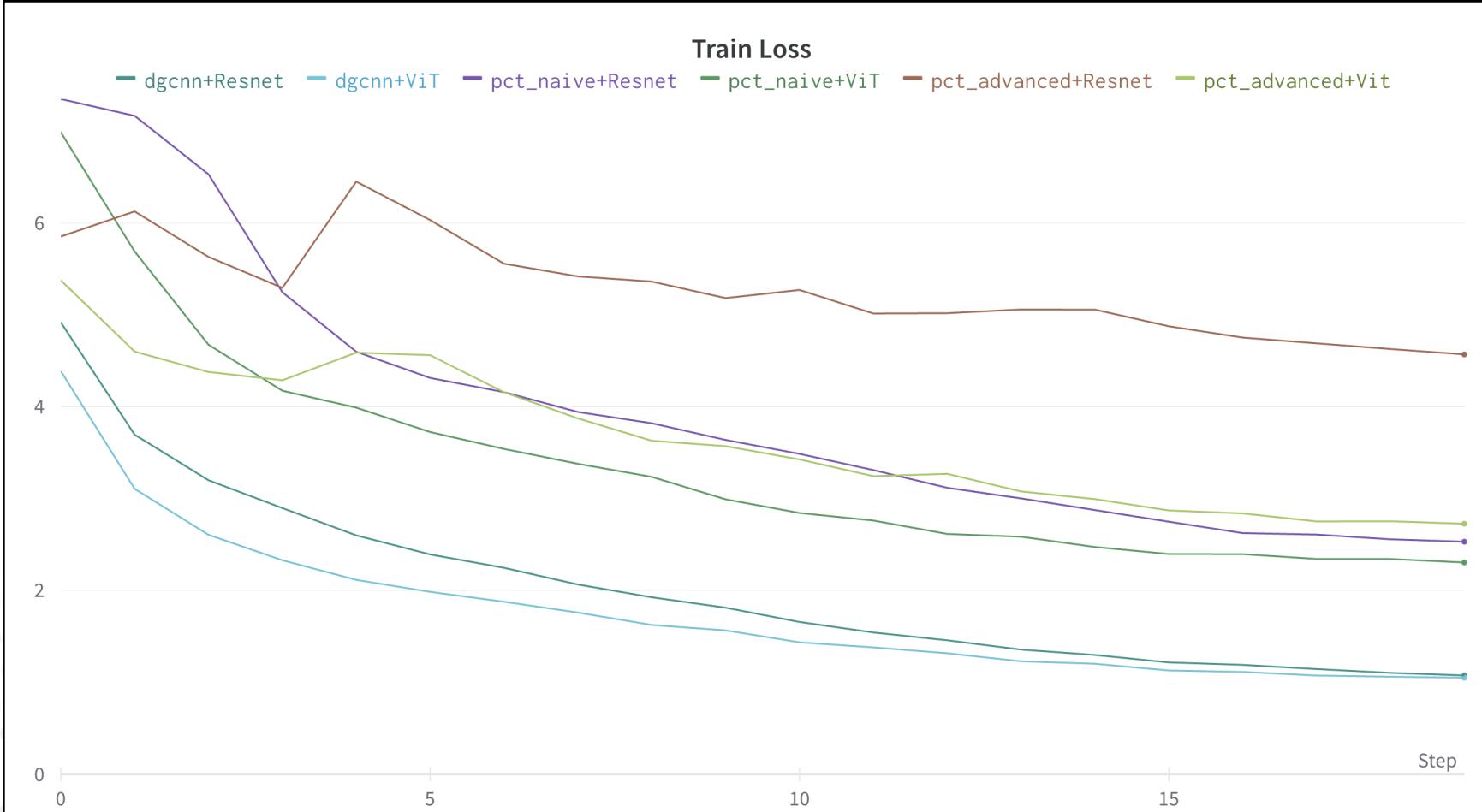


Tesla T4



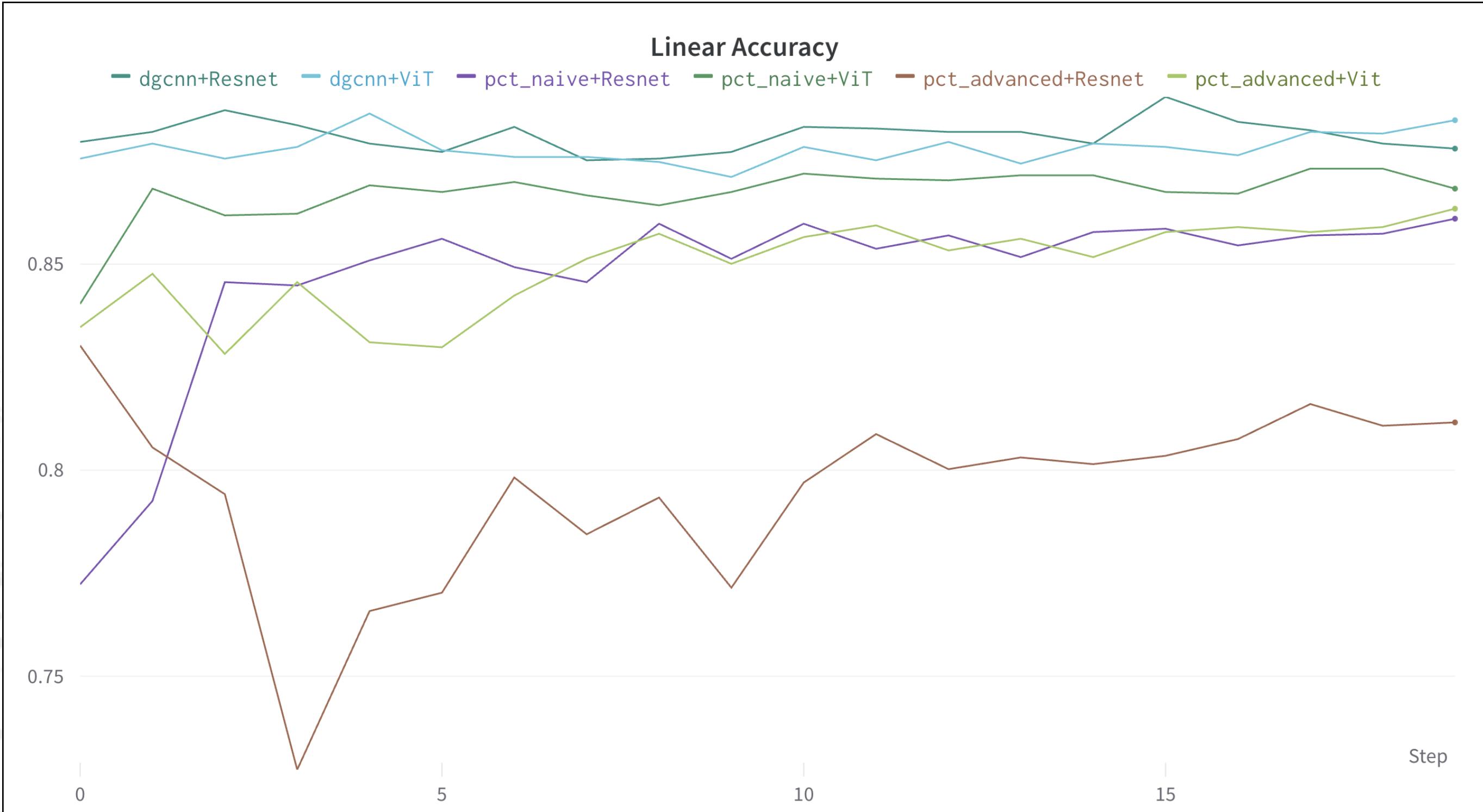
RESULT

LOSSES



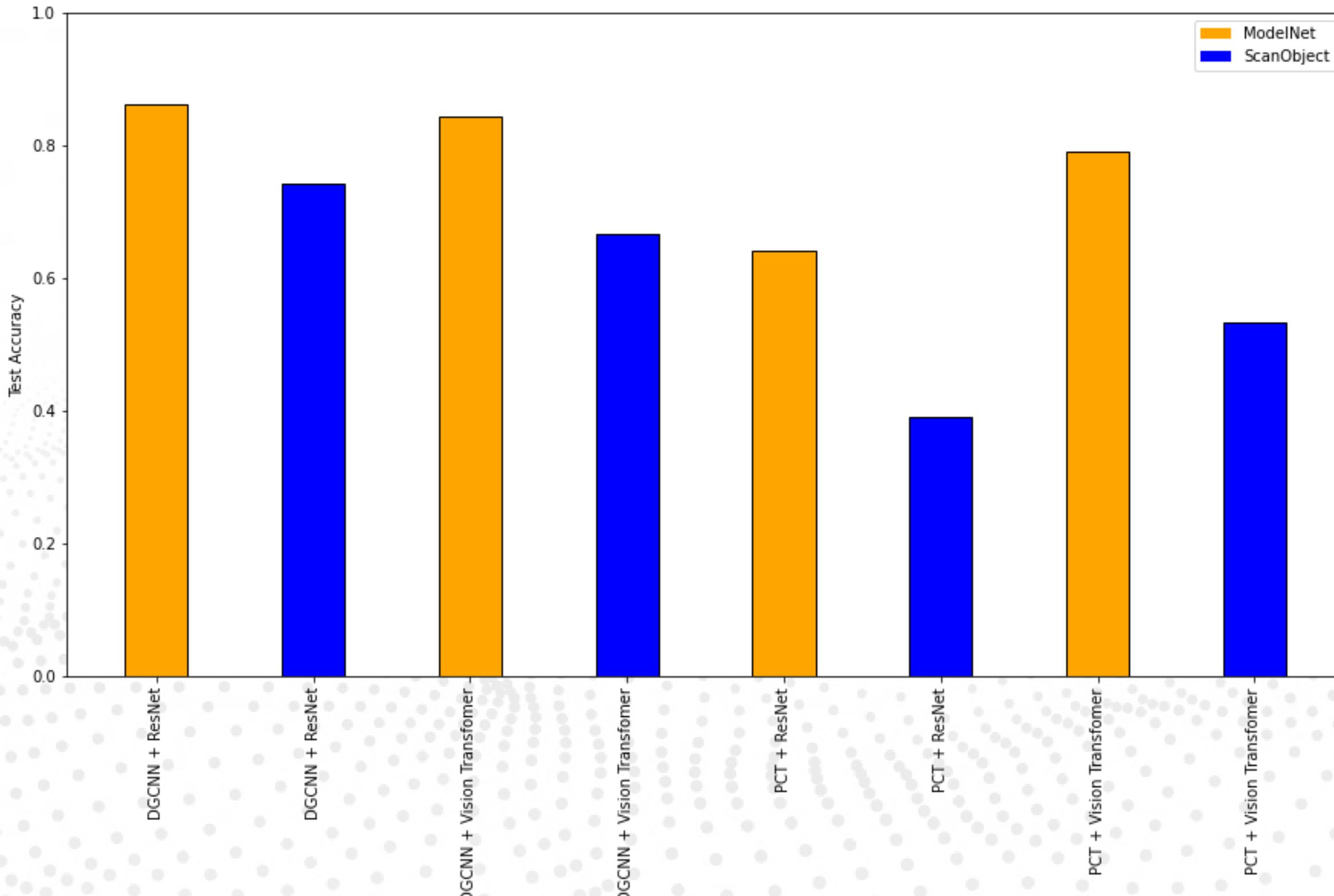
RESULT

VALIDATION ACCURACY



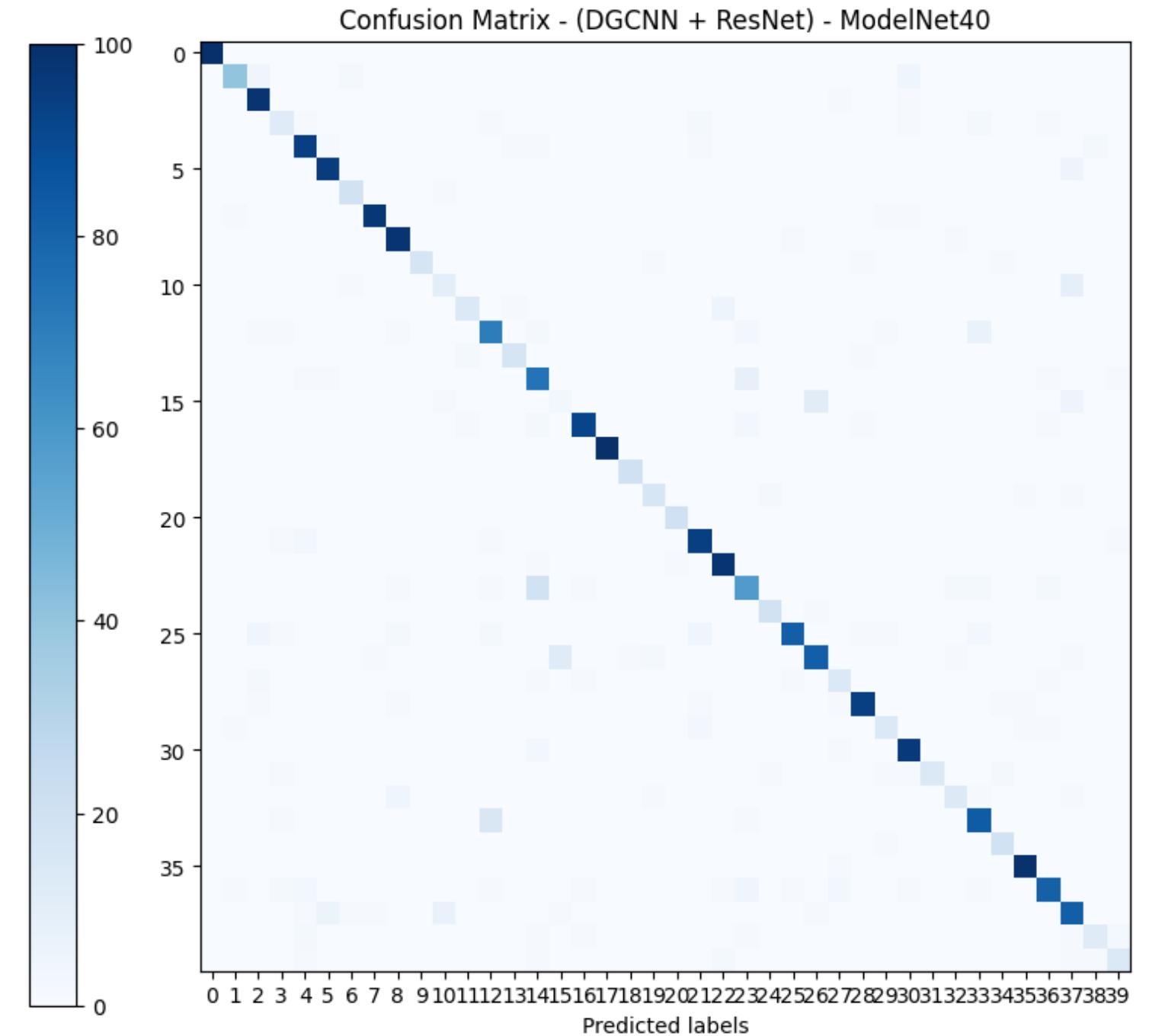
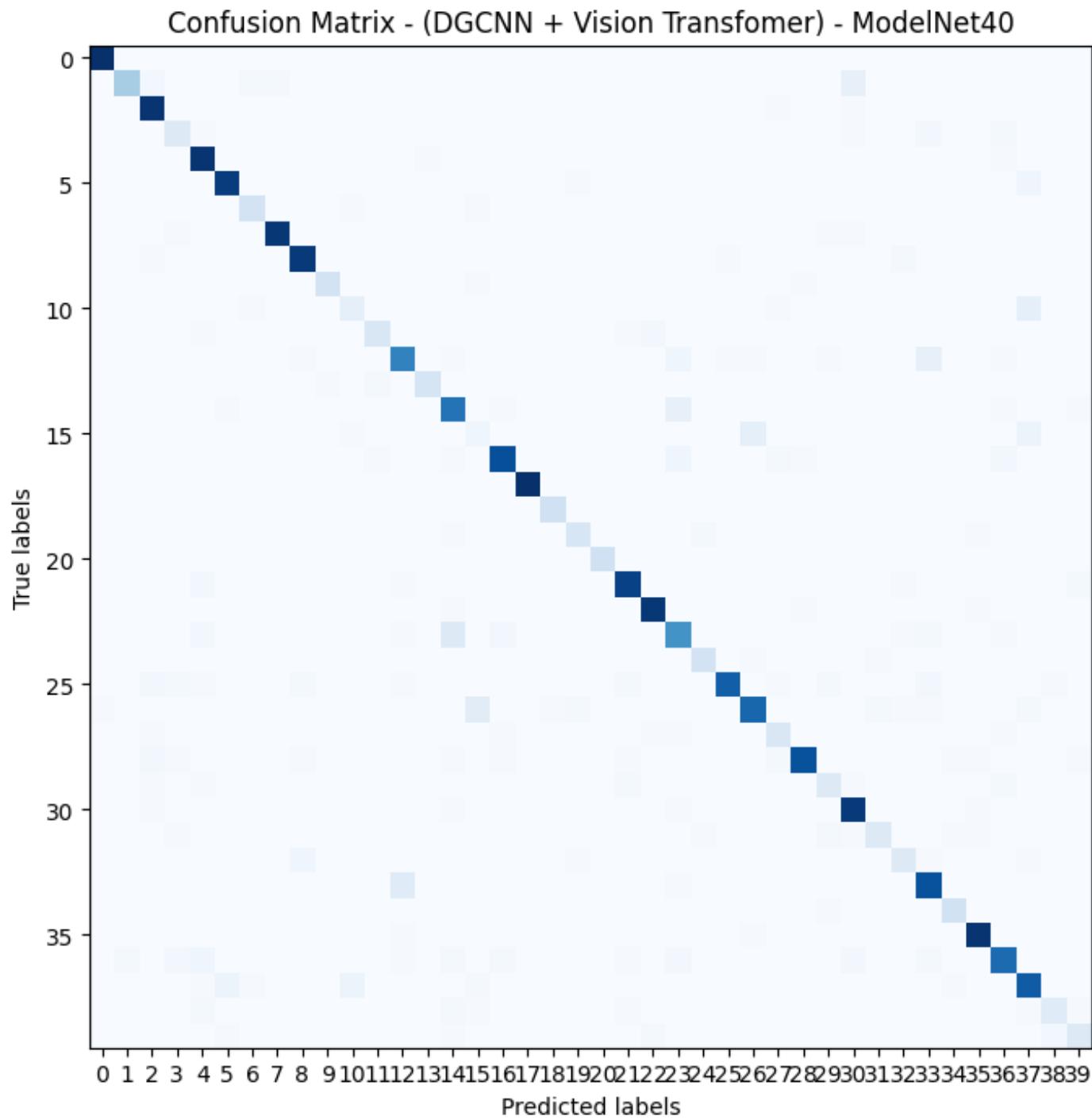
RESULT

TEST ACCURACY MODELNET & SCANOBJECT



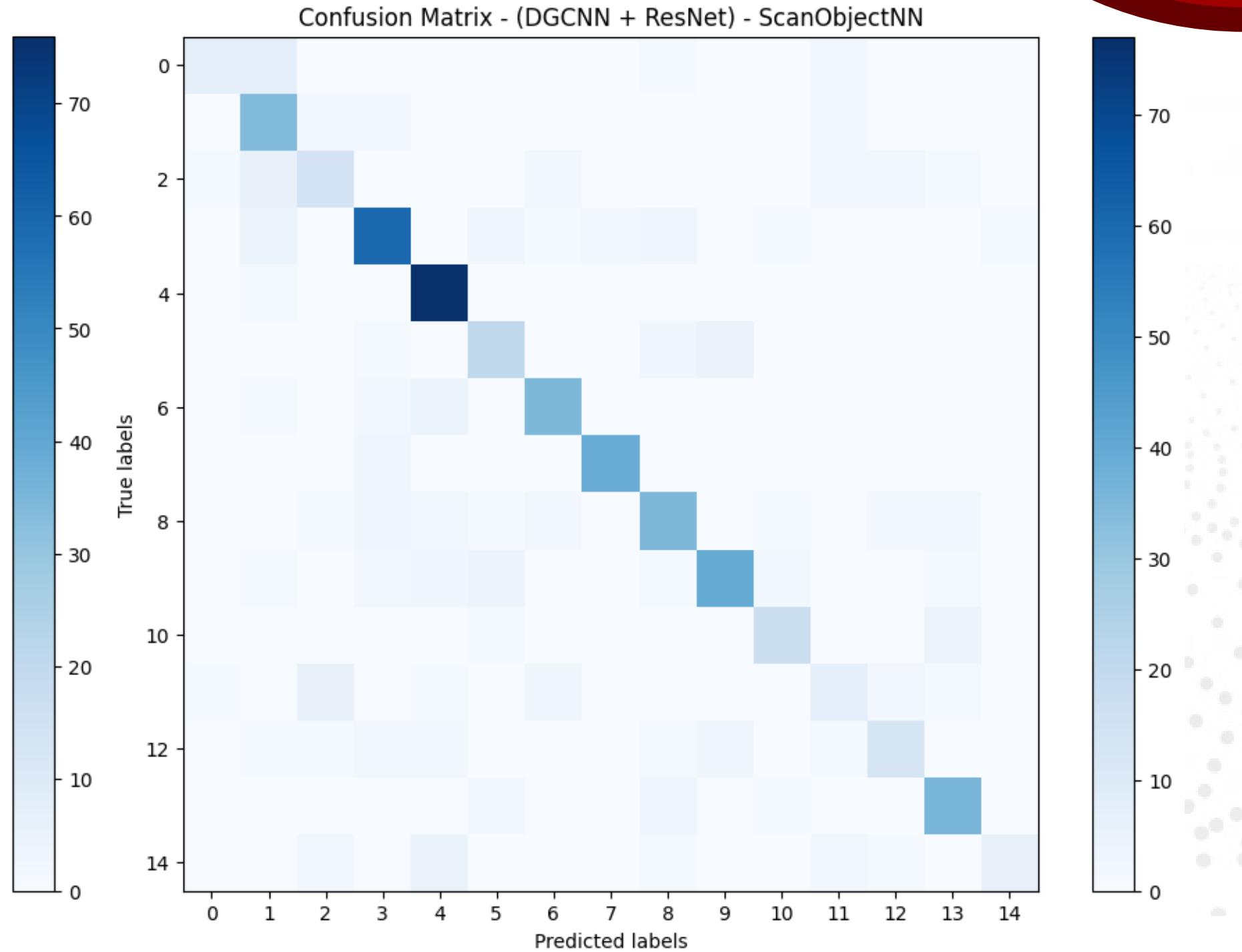
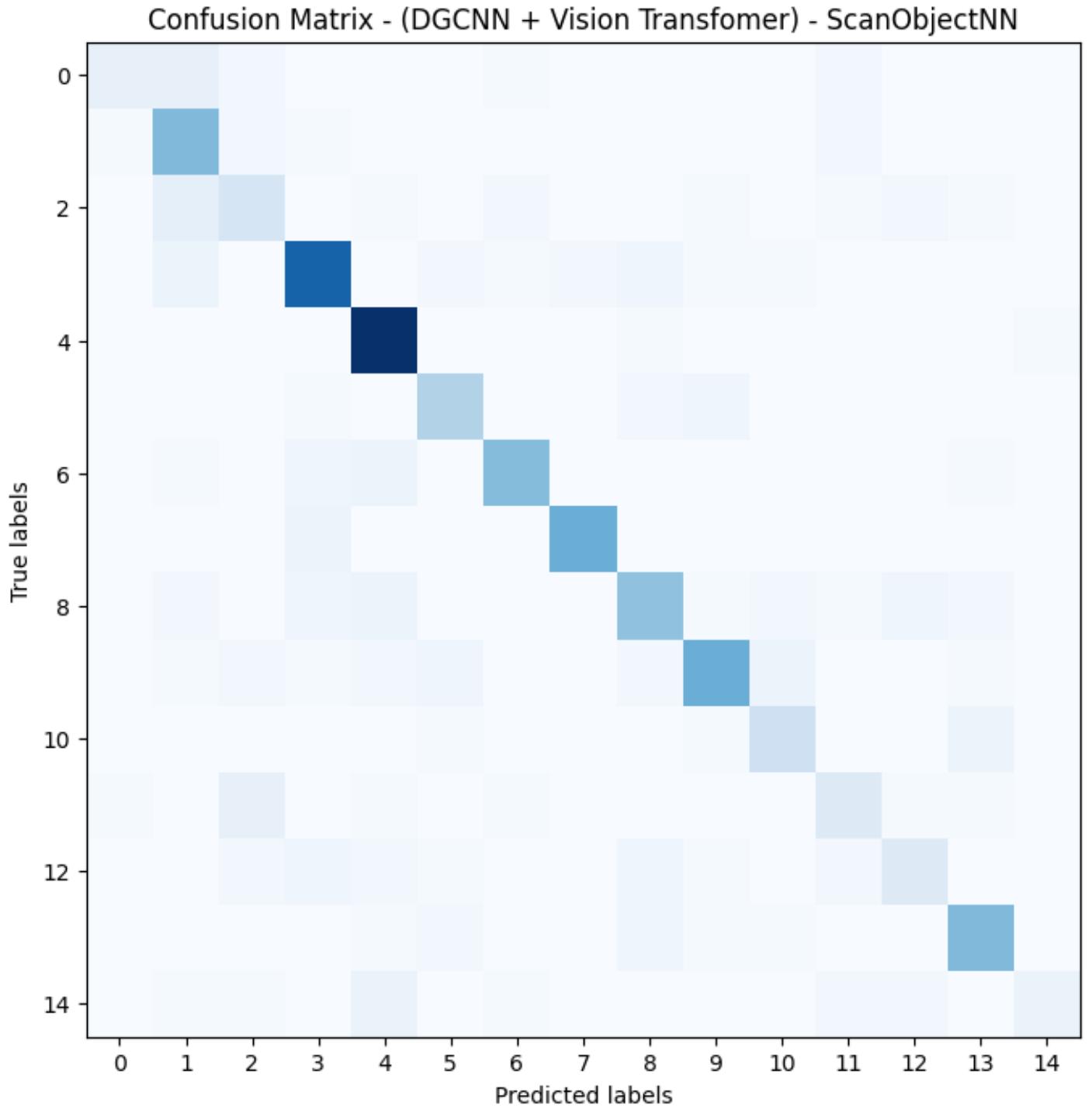
RESULT

CONFUSION MATRIX MODELNET DGCNN



RESULT

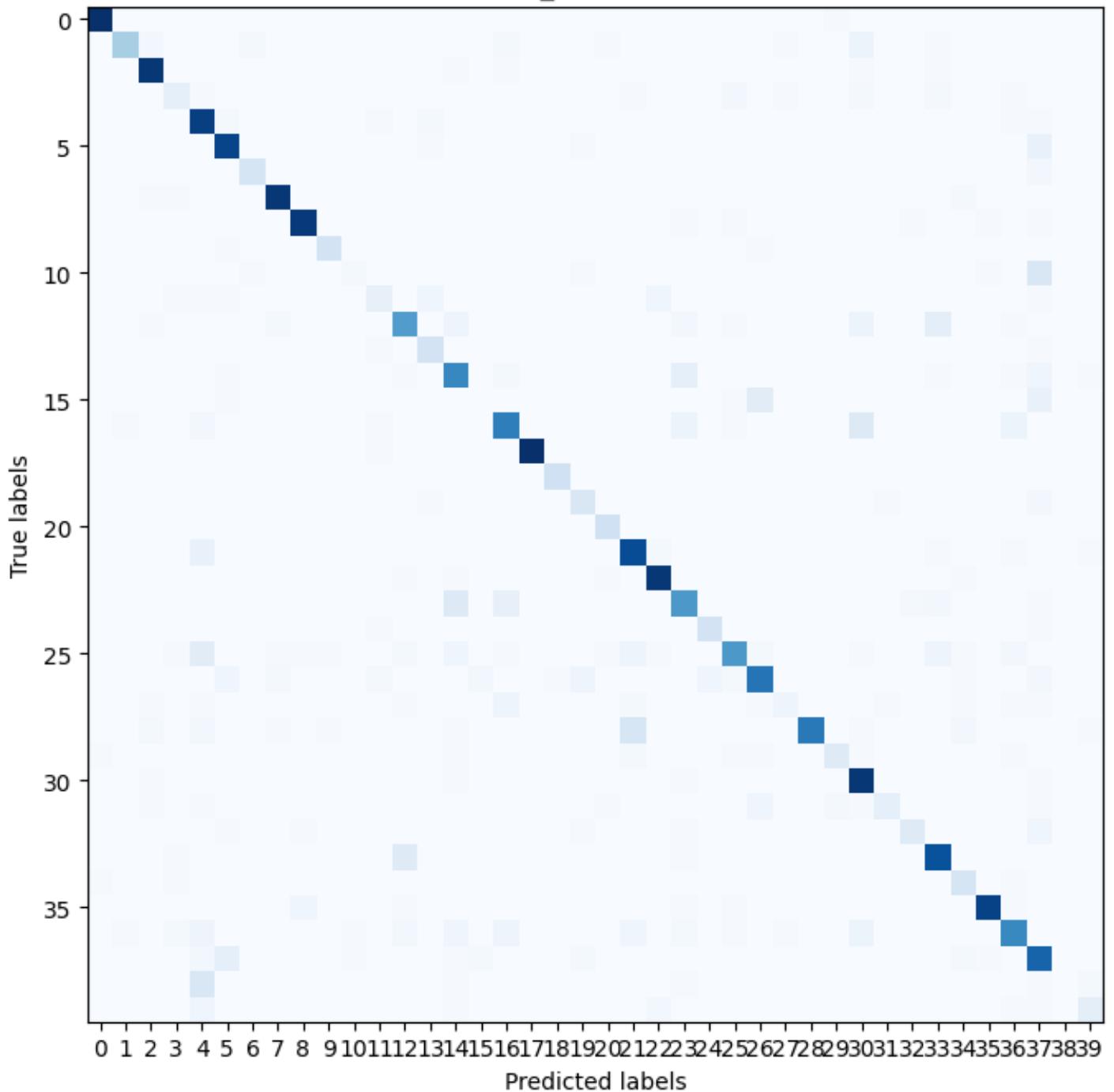
CONFUSION MATRIX SCANOBJECT DGCNN



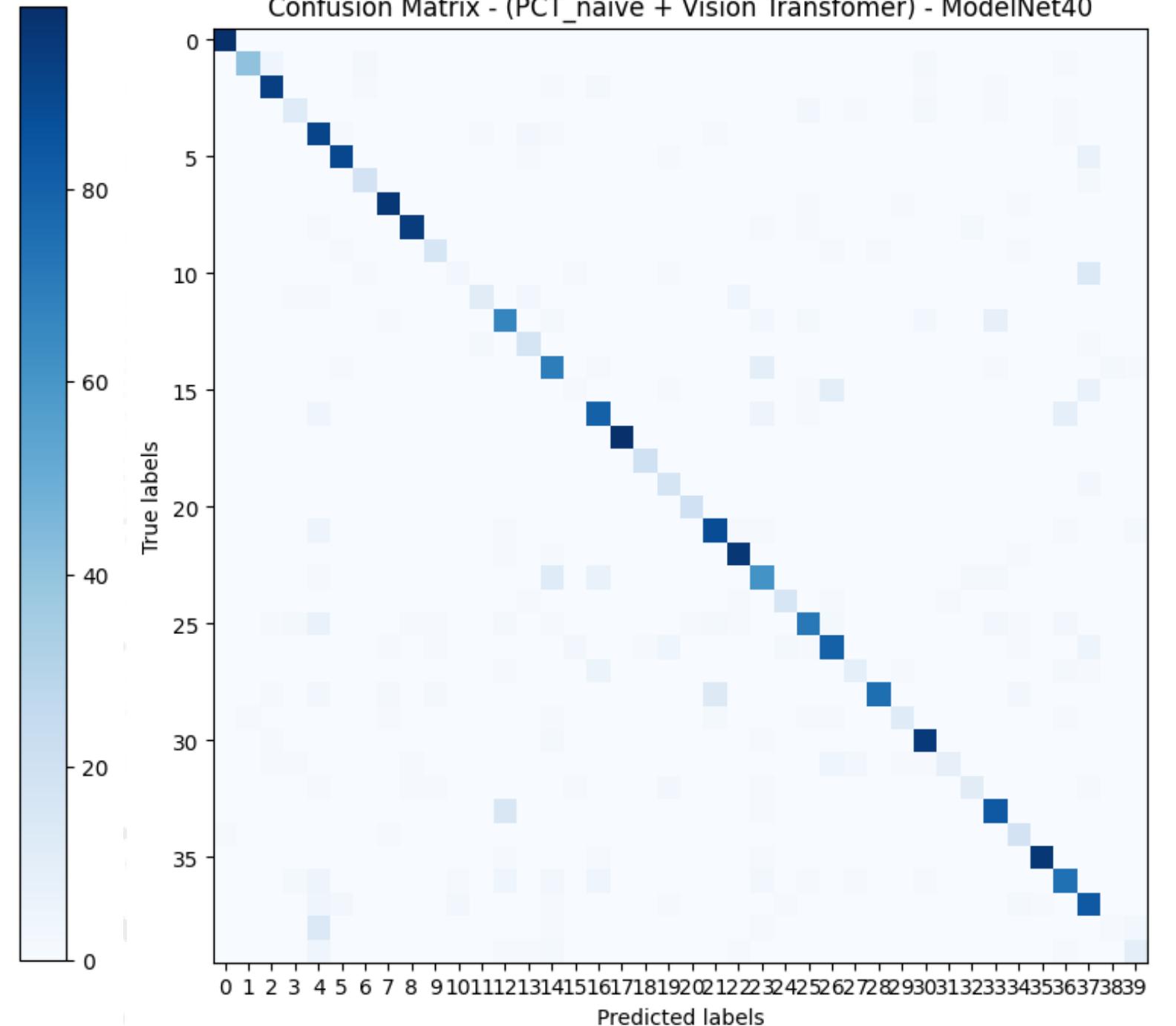
RESULT

CONFUSION MATRIX MODELNET PCT NAIVE

Confusion Matrix - (PCT_naive + ResNet) - ModelNet40

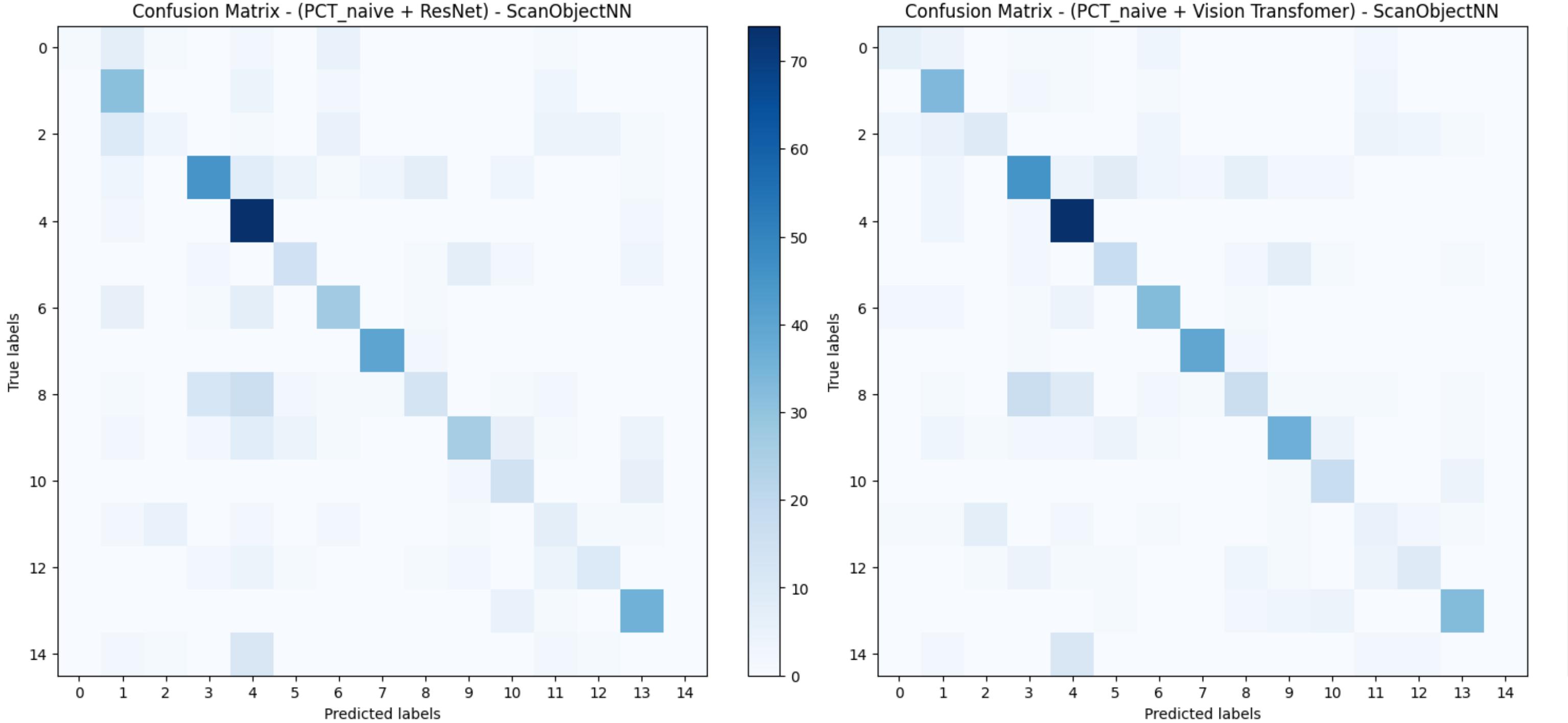


Confusion Matrix - (PCT_naive + Vision Transformer) - ModelNet40



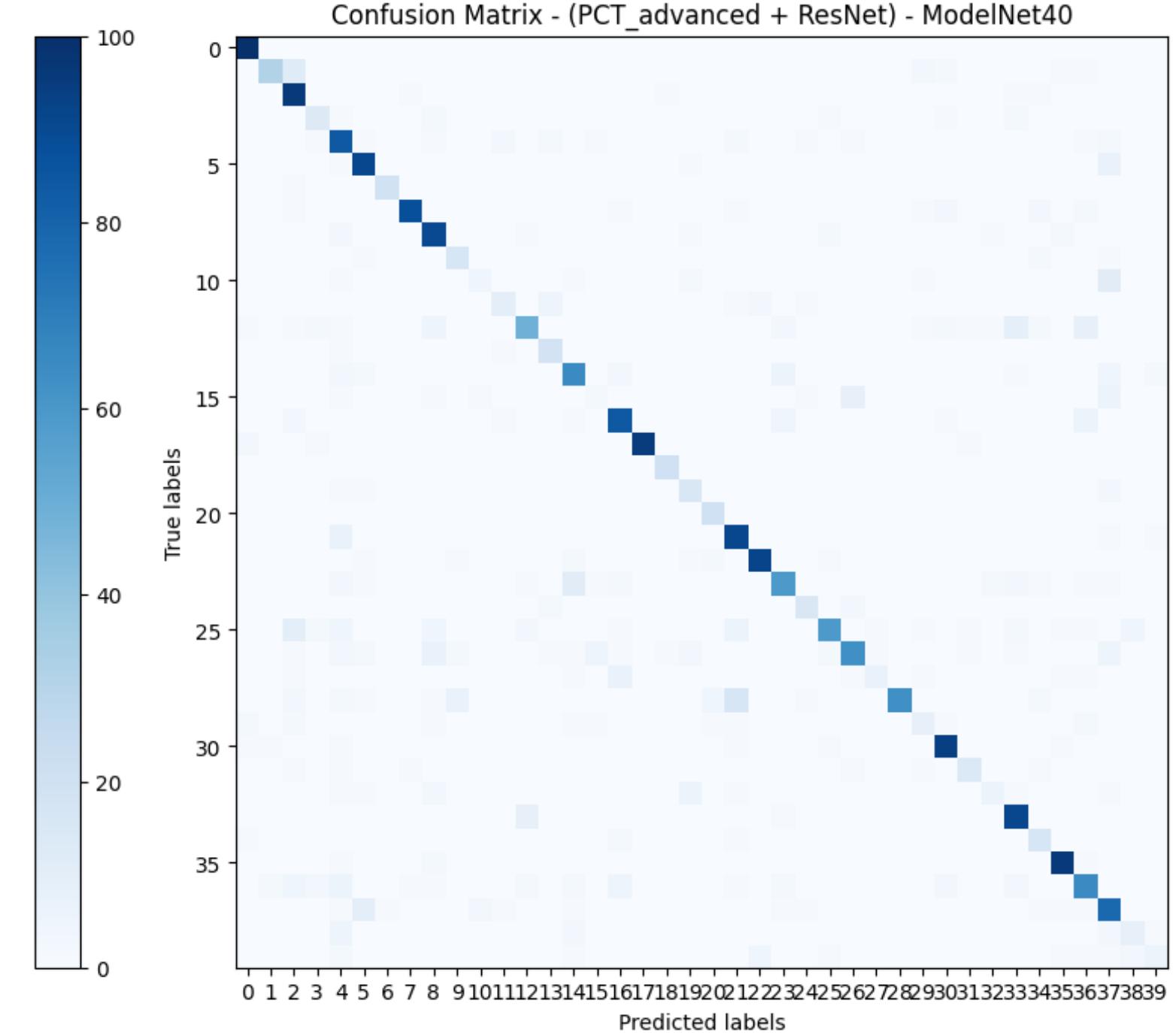
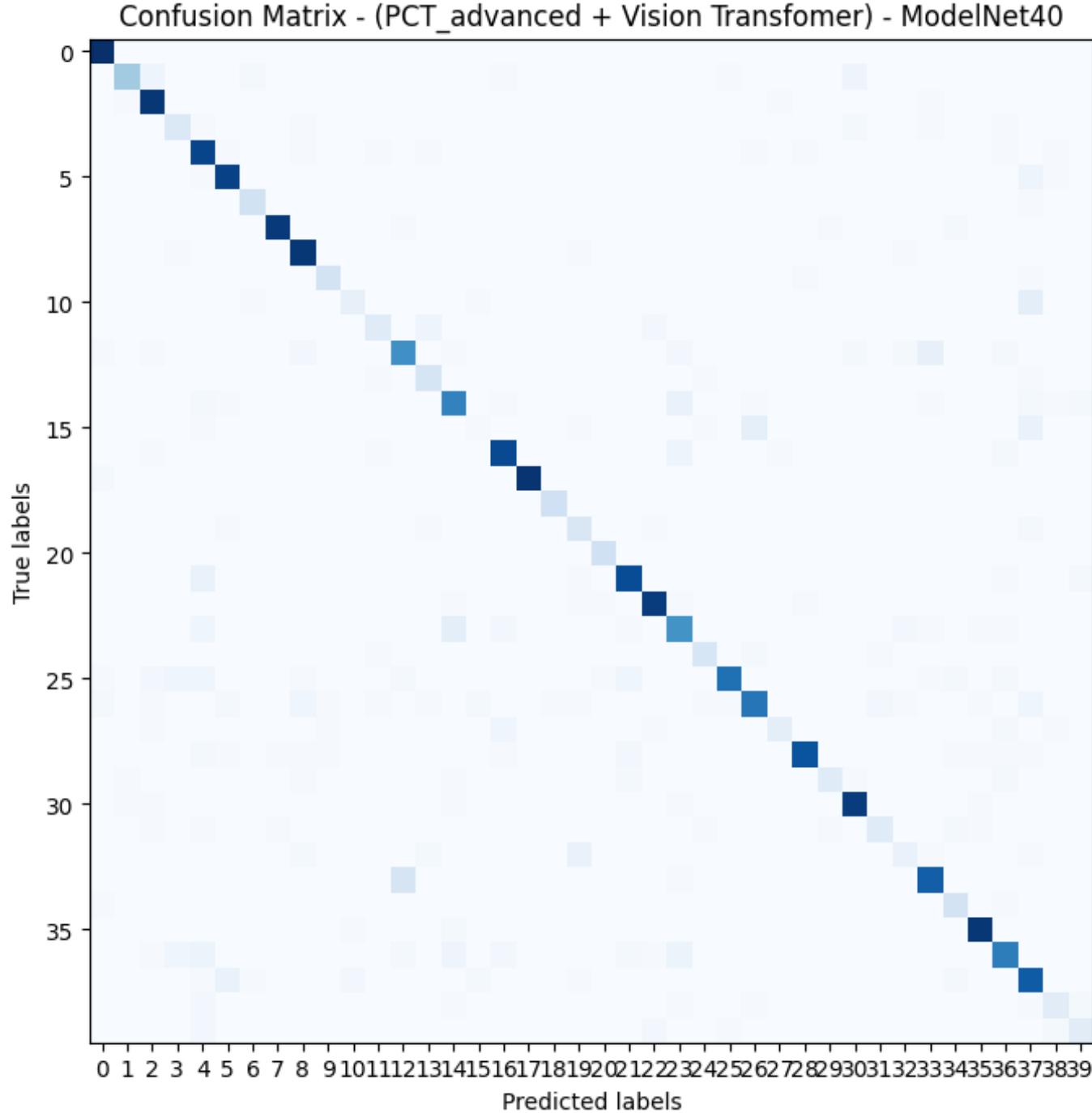
RESULT

CONFUSION MATRIX SCANOBJECT PCT NAIVE



RESULT

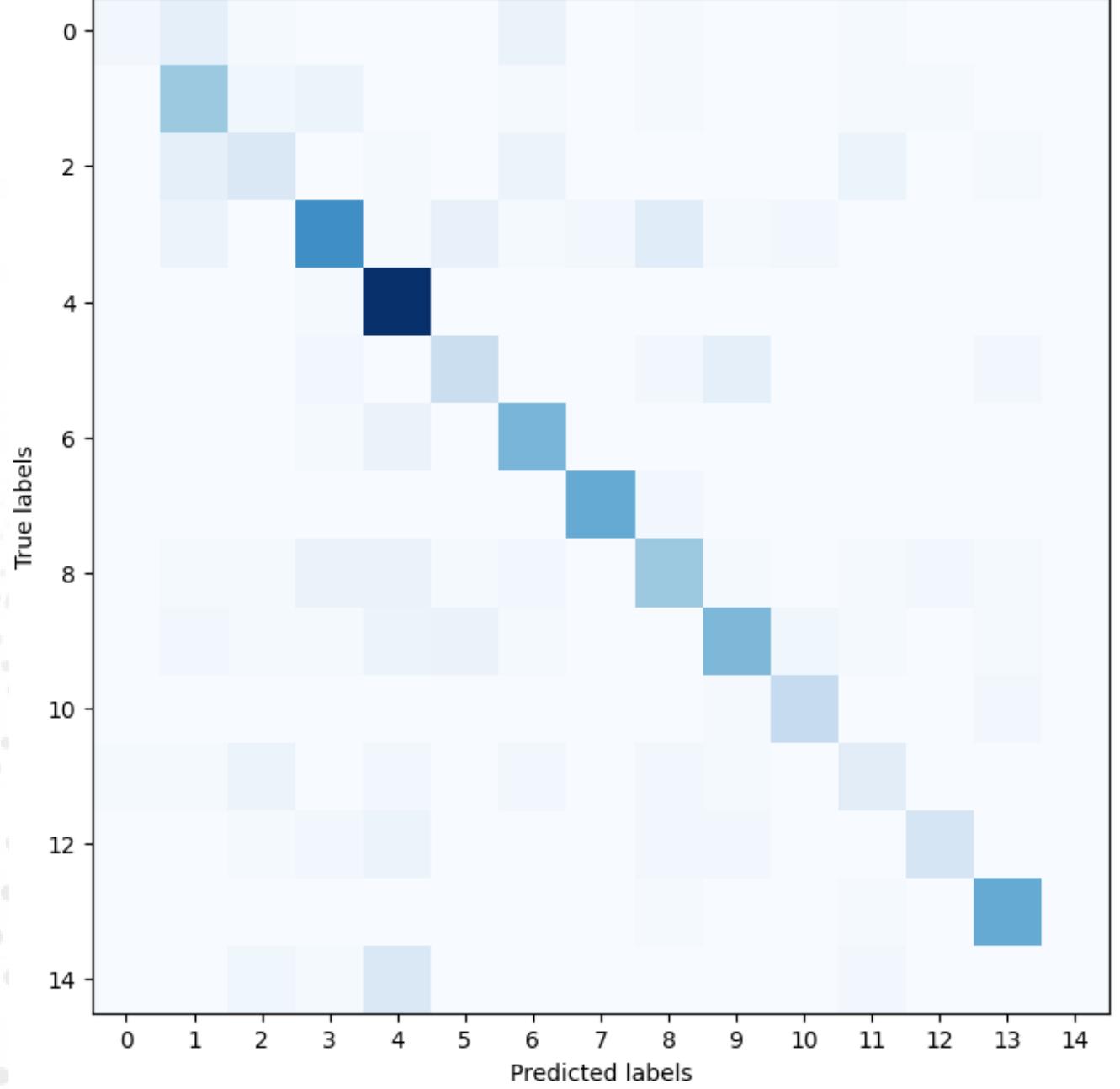
CONFUSION MATRIX MODELNET PCT ADVANCED



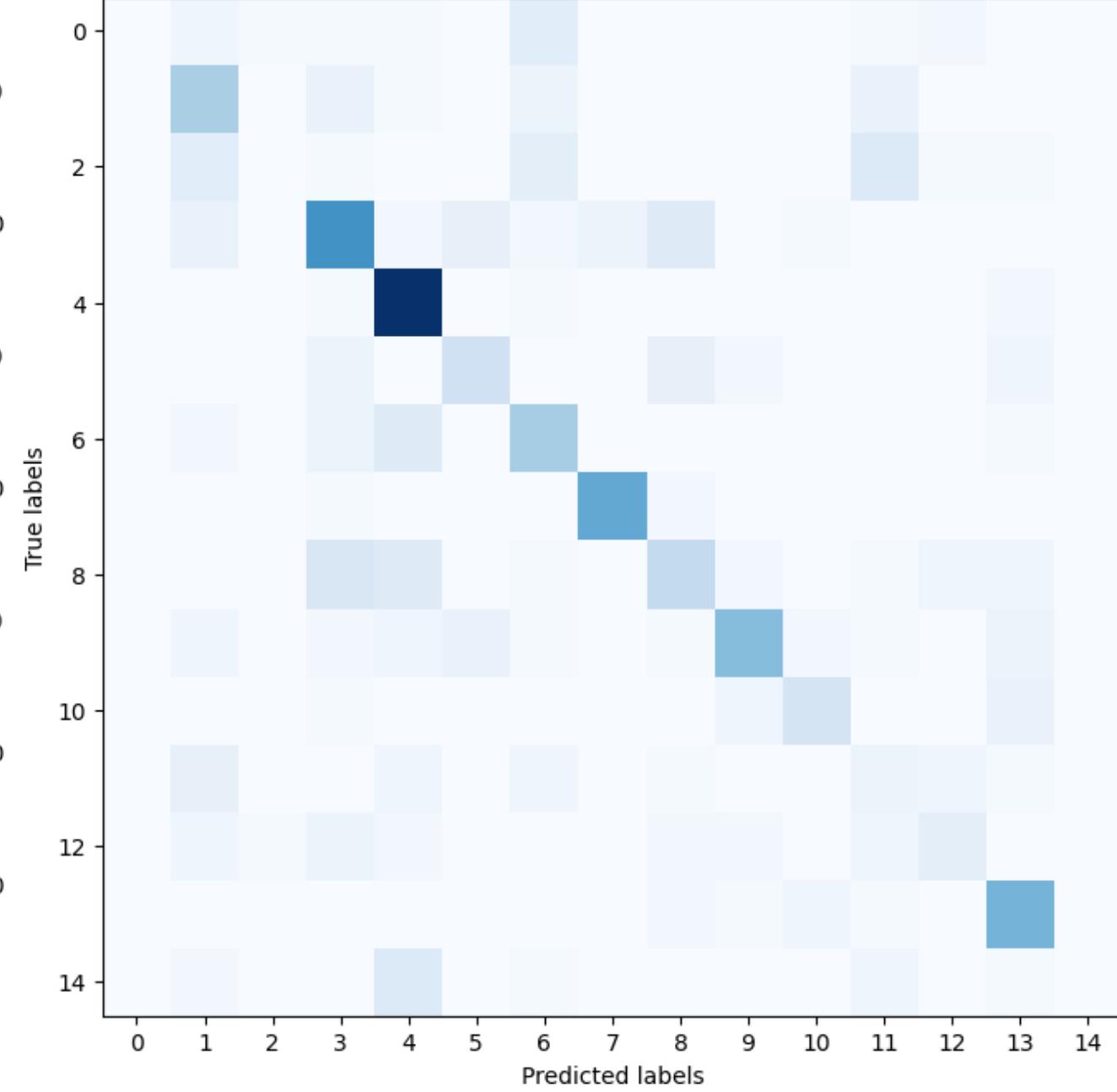
RESULT

CONFUSION MATRIX SCANOBJECT PCT ADVANCED

Confusion Matrix - (PCT_advanced + Vision Transformer) - ScanObjectNN



Confusion Matrix - (PCT_advanced + ResNet) - ScanObjectNN

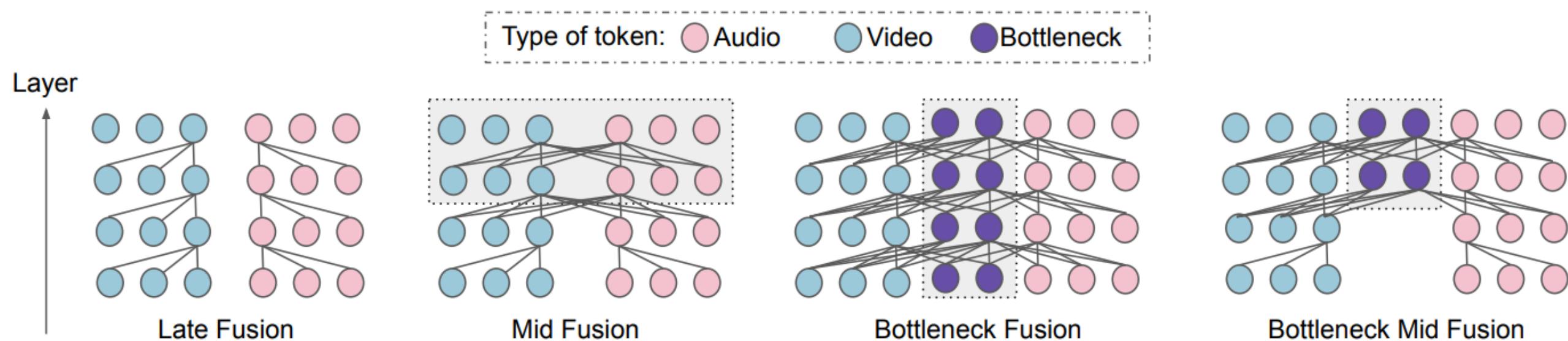


LIMITATIONS

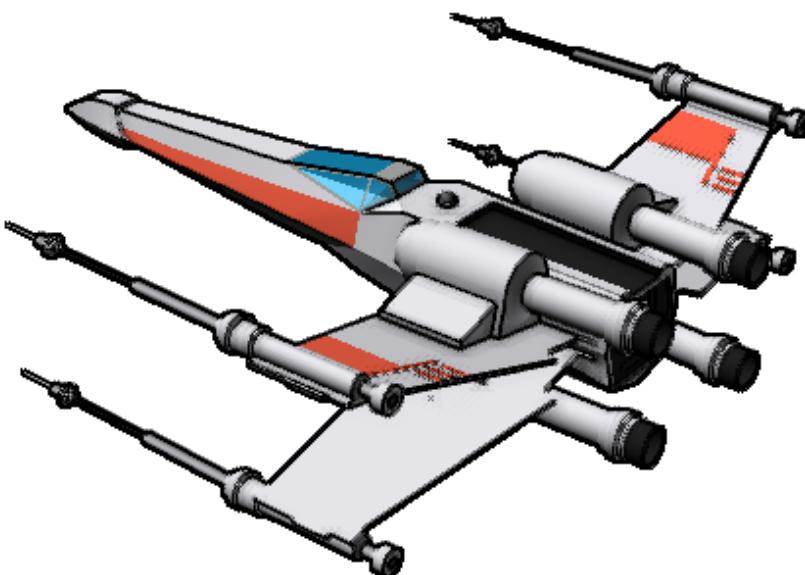
- Few Epoch
- Few Class
- Limited Dataset

FURTHER DEVELOPMENT

FUSION STRATEGY



THE
END.



QUESTIONS ?

LUDOVICO COMITO - RUCCI EMANUELE