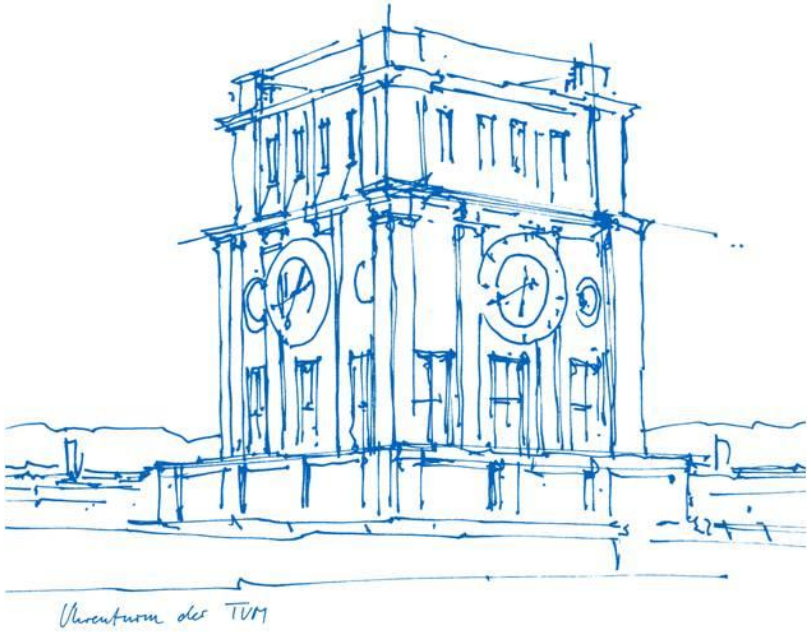
RecMVCNN - Simultaneous Classification and Reconstruction

Bastian Wittmann, Andrew Desousa, Florian Donhauser

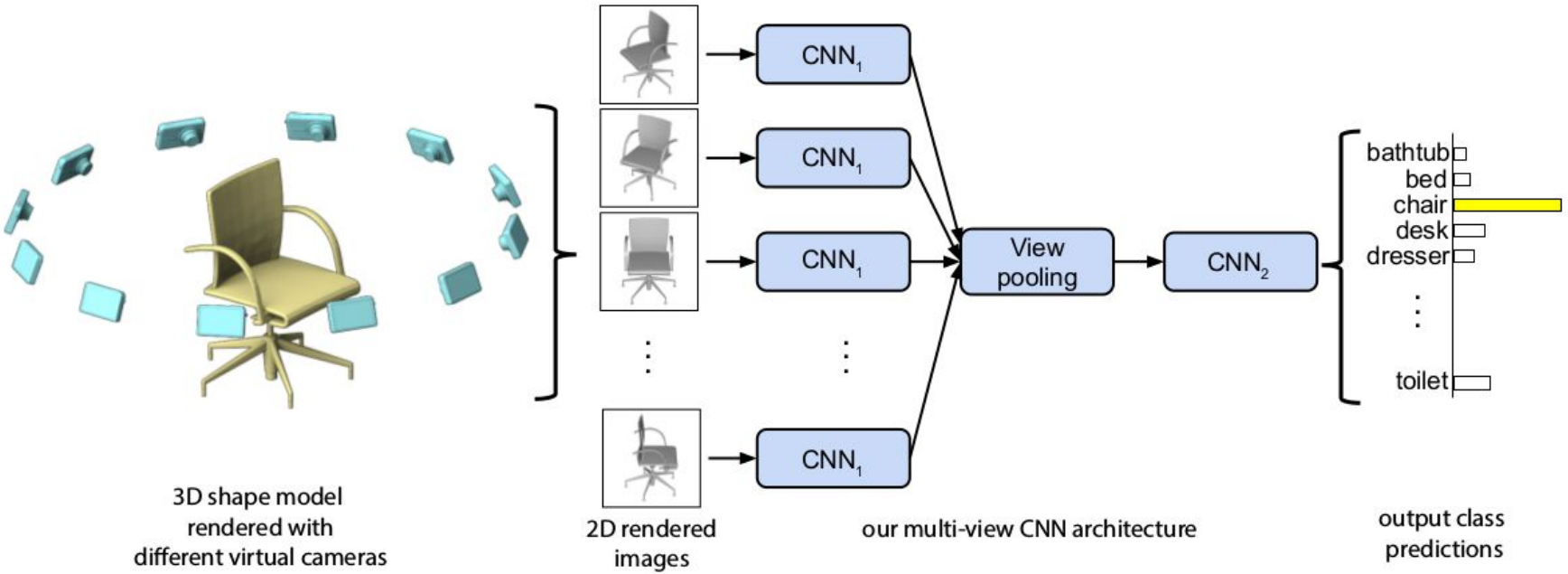
Technische Universität München

Machine Learning for 3D Geometry

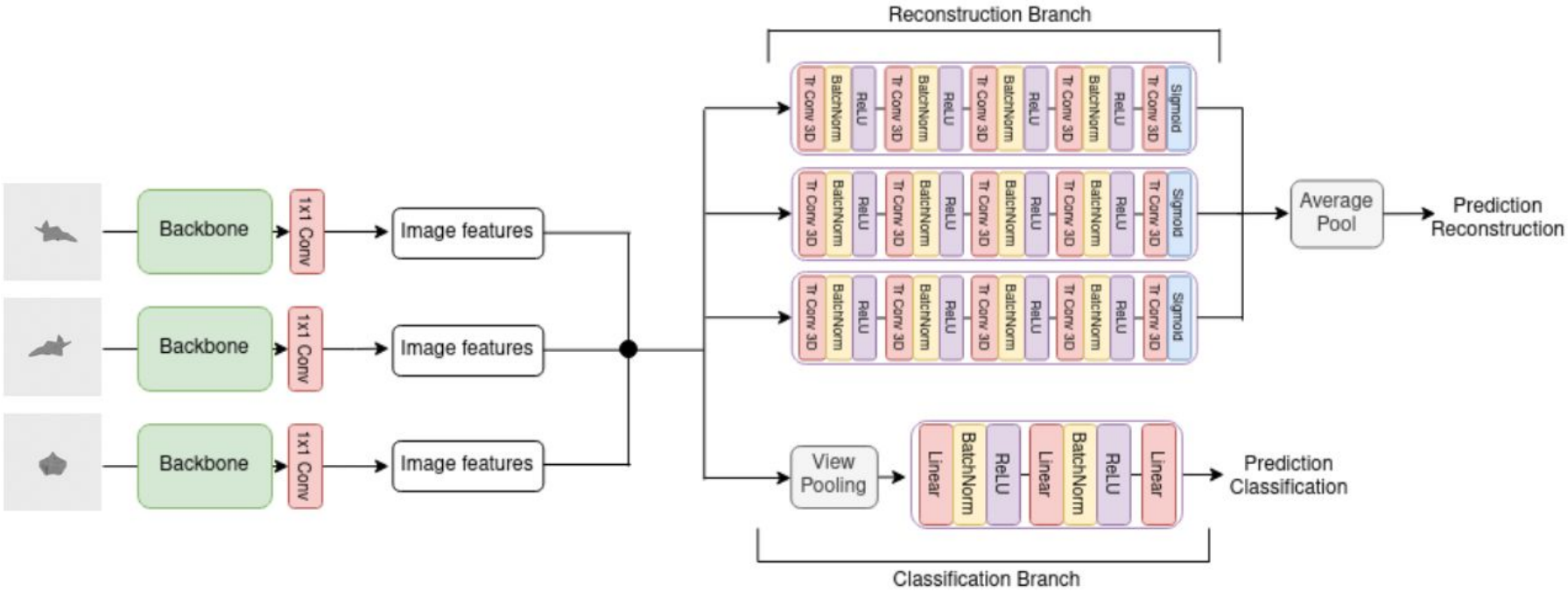
München, 22.07.2021



MVCNN by Su et al. (2015)

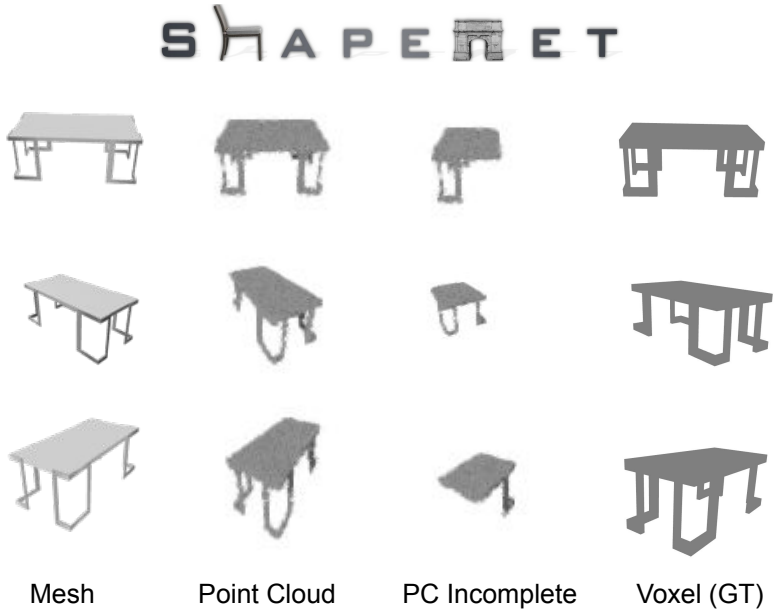


RecMVCNN


Reconstruction Branch
Backbone
1x1 Conv
Image features
Backbone
1x1 Conv
Image features
Backbone
1x1 Conv
Image features
Tr Conv 3D
BatchNorm
ReLU
Sigmoid
Average Pool
Prediction Reconstruction
View Pooling
Linear
BatchNorm
ReLU
Prediction Classification
Classification Branch

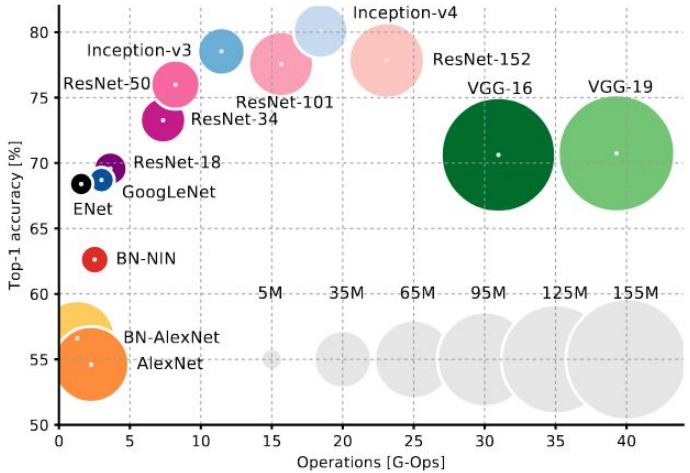
Data

- 13 major categories and 39,406 examples
- 24-view mesh renderings
- 3-view point cloud renderings

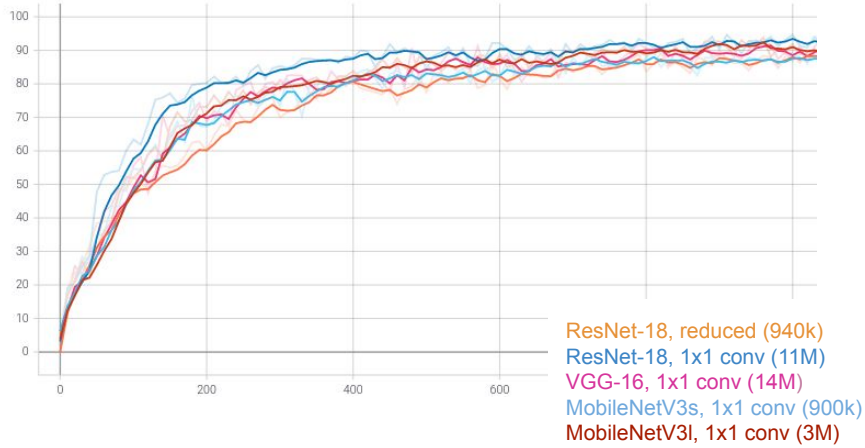


Our Process - Backbone Selection

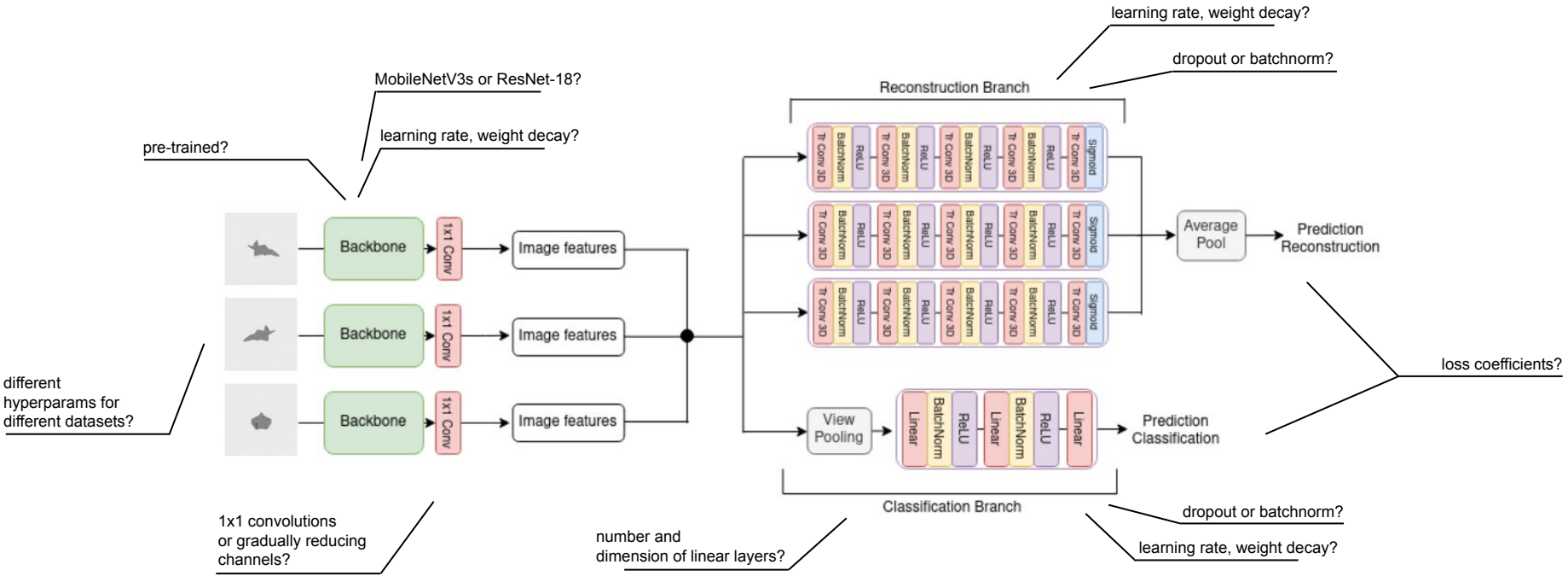
Trade-off between performance and the number of parameters



Alfredo Canziani, ‘An Analysis of Deep Neural Network Models for Practical Applications’



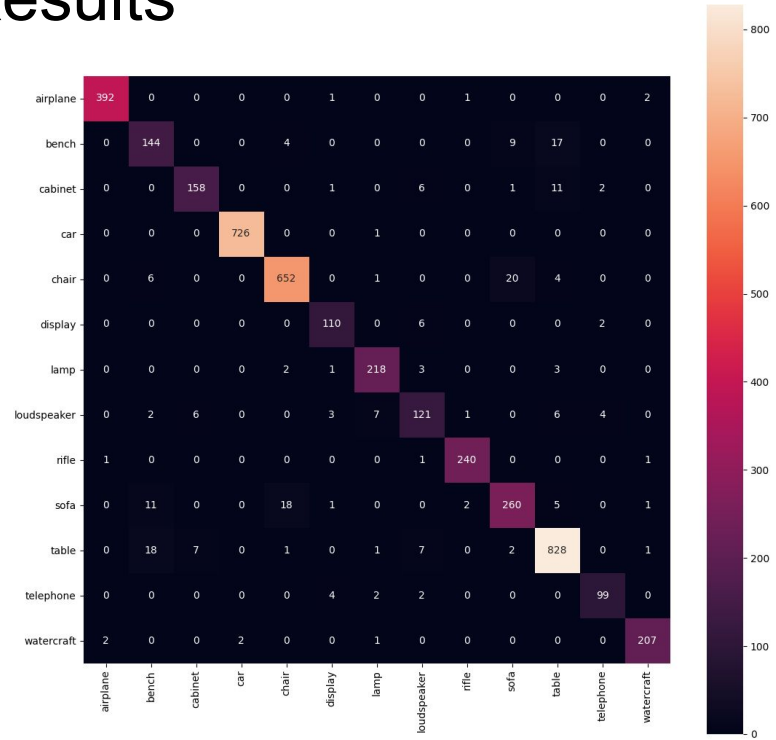
Our Process - Hyperparameter Tuning



Results

Method	Backbone	#Views	Cls. Weight	Rec. Weight	Classification Acc.	Reconstruction IoU
ShapeNet Mesh Renderings Test Set						
RecMVCNN	MobileNetV3s	3	1	0	94.52	-
RecMVCNN	ResNet-18	3	1	0	94.79	-
RecMVCNN	ResNet-18	3	0.5	0.5	94.77	39.20
RecMVCNN	ResNet-18	3	0.2	0.8	94.88	40.04
RecMVCNN	ResNet-18	3	0.05	0.95	94.88	40.89
RecMVCNN	ResNet-18	3	0	1	-	41.17
ShapeNet Point Cloud Renderings Test Set						
RecMVCNN	ResNet-18	3	1	0	64.30	-
RecMVCNN	ResNet-18	3	0	1	-	14.62

Results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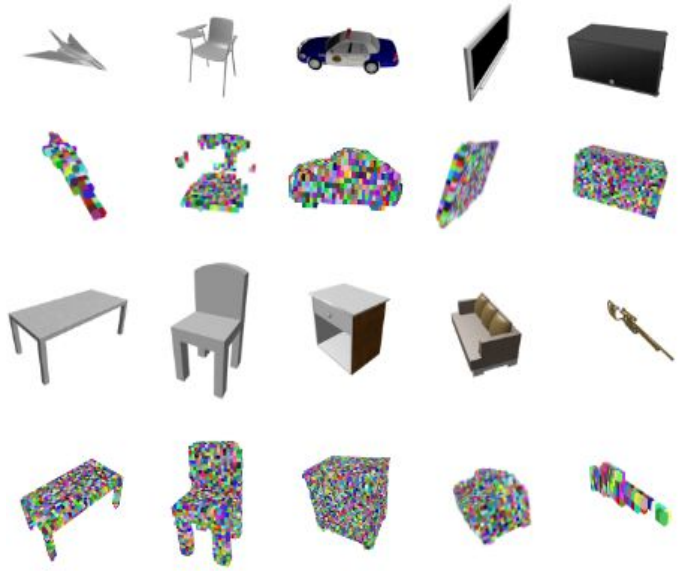
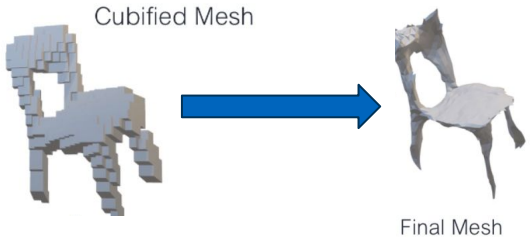
bench 0 144 0 0 4 0 0 0 0 9 17 0 0
cabinet 0 0 158 0 0 1 0 6 0 1 11 2 0
car 0 0 0 726 0 0 1 0 0 0 0 0 0
chair 0 6 0 0 652 0 1 0 0 20 4 0 0
display 0 0 0 0 0 110 0 6 0 0 0 2 0
lamp 0 0 0 0 2 1 218 3 0 0 3 0 0
loudspeaker 0 2 6 0 0 3 7 121 1 0 6 4 0
rifle 1 0 0 0 0 0 0 1 240 0 0 0 1
sofa 0 11 0 0 18 1 0 0 2 260 5 0 1
table 0 18 7 0 1 0 1 7 0 2 828 0 1
telephone 0 0 0 0 0 4 2 2 0 0 0 99 0
watercraft 2 0 0 2 0 0 1 0 0 0 0 0 207
airplane
bench
cabinet
car
chair
display
lamp
loudspeaker
rifle
sofa
table
telephone
watercraft
800
700
600
500
400
300
200
100
0



Conclusion And Future Work

https://www.nvidia.com/de-de/geforce/graphics-cards/30-series/rtx-3070-3070ti/

https://developer.nvidia.com/blog/introducing-hgx-a100-most-powerful-accelerated-server-platform-for-ai-hpc/



https://gkioxari.github.io/meshrcnn/

Thank you for your time!