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Duality Diagram Similarity: a generic framework for initialization selection in task transfer learning

Kshitij Dwivedi[1,3], Jiahui Huang[2], Radoslaw Martin Cichy[3], Gemma Roig[1]

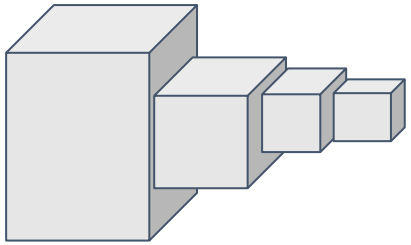
GOETHE UNIVERSITÄT FRANKFURT AM MAIN

SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

Freie Universität Berlin

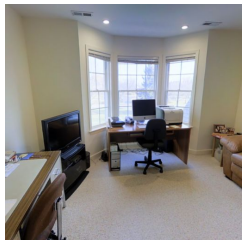
Initialization selection for transfer learning

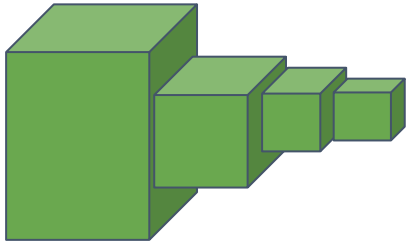
New task: Semantic segmentation

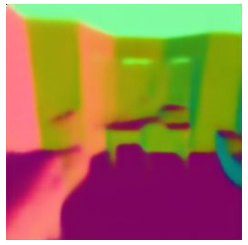


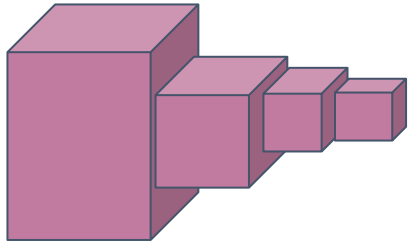
Goal:
DeepNet → best transfer performance

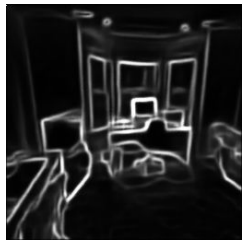
Initialize from a pretrained model









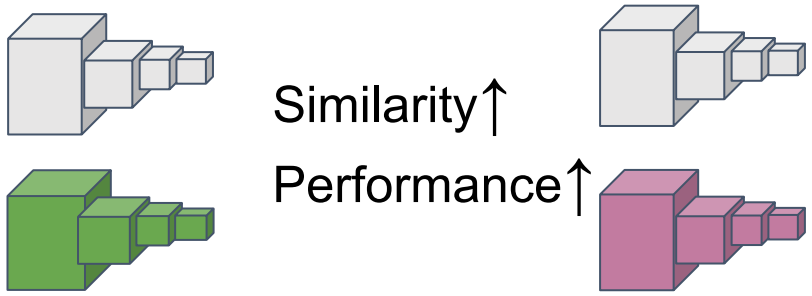


Duality Diagram Similarity (DDS) selects
1. pretrained model
2. layer of the pretrained model

for best transfer performance

K.D

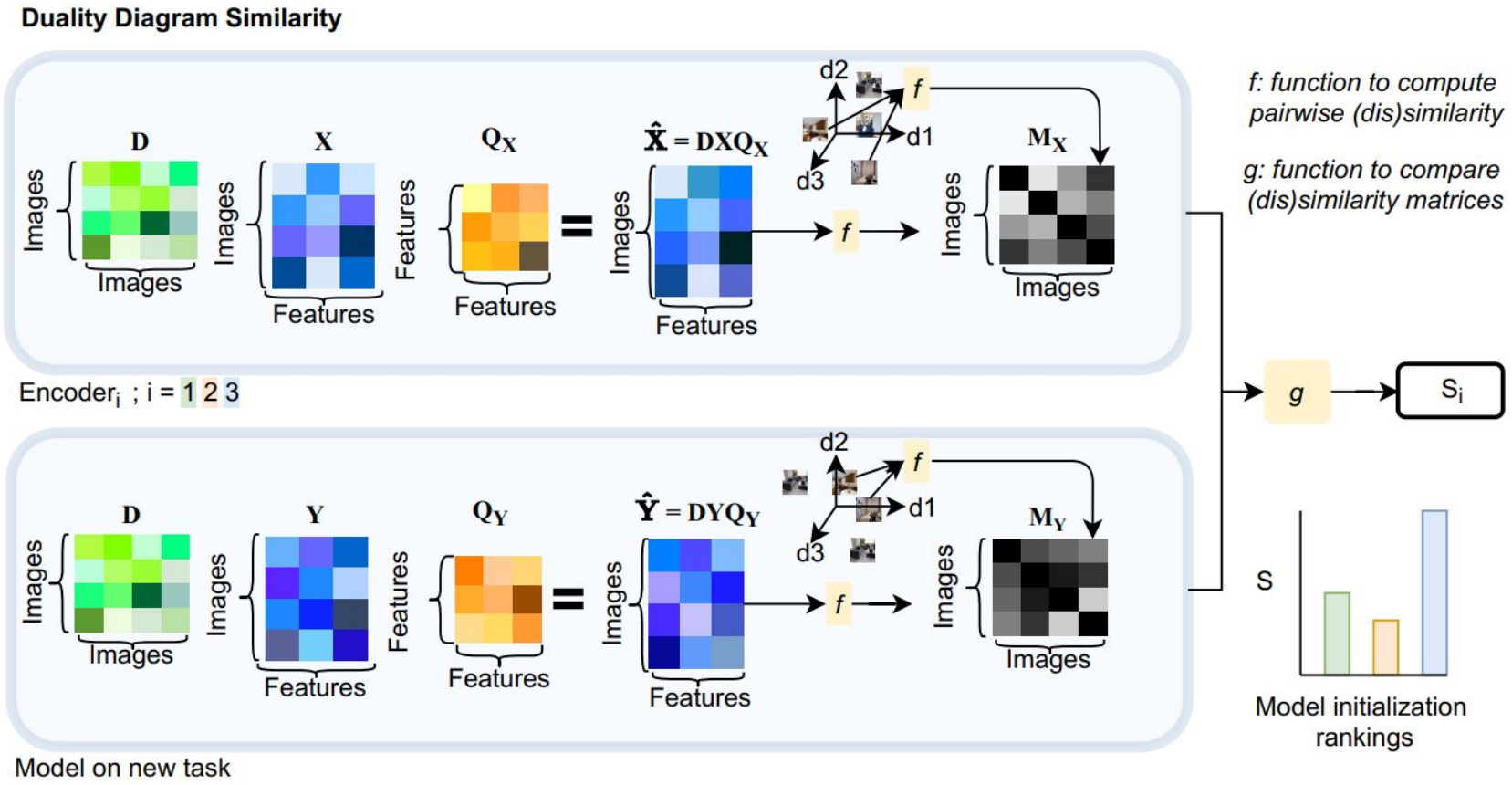
Task similarity ↔ Transfer learning performance



Similarity↑
Performance↑

Similarity↓
Performance↓

Idea explored previously in
1. Dwivedi & Roig, CVPR 2019
2. Song et al., NeurIPS 2019

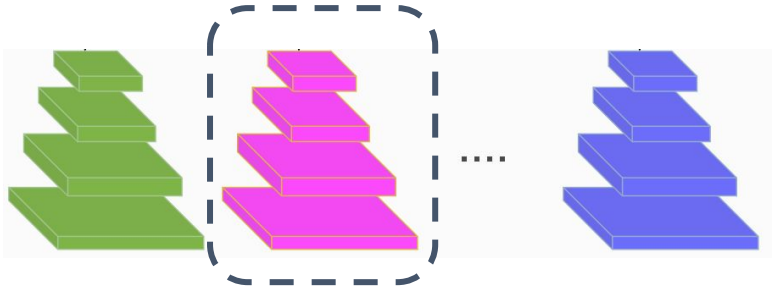


DDS allows exploring different
1. feature normalizations
2. similarity functions

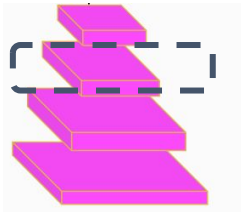
K.D

Results

- DDS finds model initialization with high transfer performance



- DDS finds best branching to transfer from



Method	Affinity	Winrate	Total time(s)
Taskonomy Winrate [48]	0.988	1	1.6×10^7
Taskonomy affinity [48]	1	0.988	1.6×10^7
saliency [41]	0.605	0.600	3.2×10^3
DeepLIFT [41]	0.681	0.682	3.3×10^3
ϵ-LRP [41]	0.682	0.682	5.6×10^3
RSA [9]	0.777	0.767	78.2
DDS ($f = cosine$)	0.862	0.864	84.14
DDS ($f = Laplacian$)	0.860	0.860	103.36

Code available here

Block \ Task	Pascal VOC			NYUv2		
	Edge (MAE)	Normals (mDEG_DIFF)	Semantic (mIOU)	Edge (MAE)	Depth (log RMSE)	Semantic (mIOU)
1	**0.658**	18.09	0.257	**0.823**	0.322	0.124
2	0.686	15.59	0.392	0.857	0.290	0.165
3	0.918	**14.39**	0.627	1.297	**0.207**	0.219
4	0.900	15.11	**0.670**	1.283	0.208	**0.285**

K.D