

Connecting Sphere Manifolds Hierarchically for Regularization

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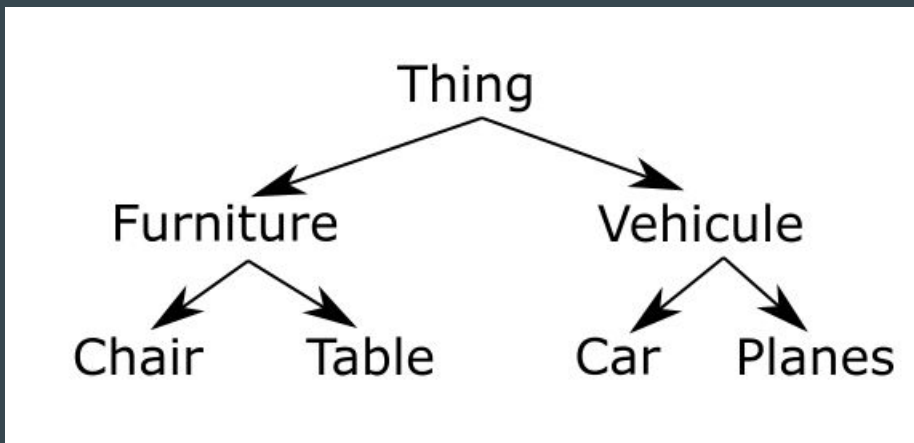
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Setting

- Classification tasks (focus on images)
- The labels are classified *hierarchically*
- The hierarchy is known (assumption: the hierarchy is a tree)



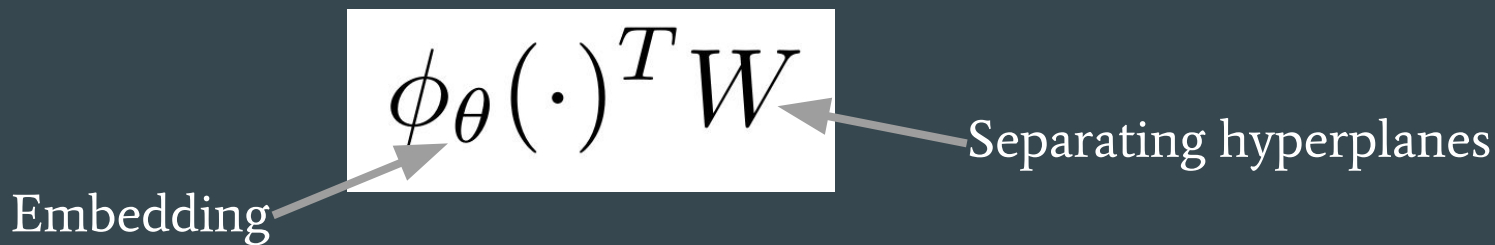
Example of datasets

- CUB200: Bird breeds classified into super-breed.

Example: Black_footed_Albatross, Laysan_Albatross are both “Albatross”.

- CARS
- DOGS
- CIFAR100
- (Tiny)ImNet

Main idea



Observation: separating hyperplanes of *same* hyper-class should be *similar*.

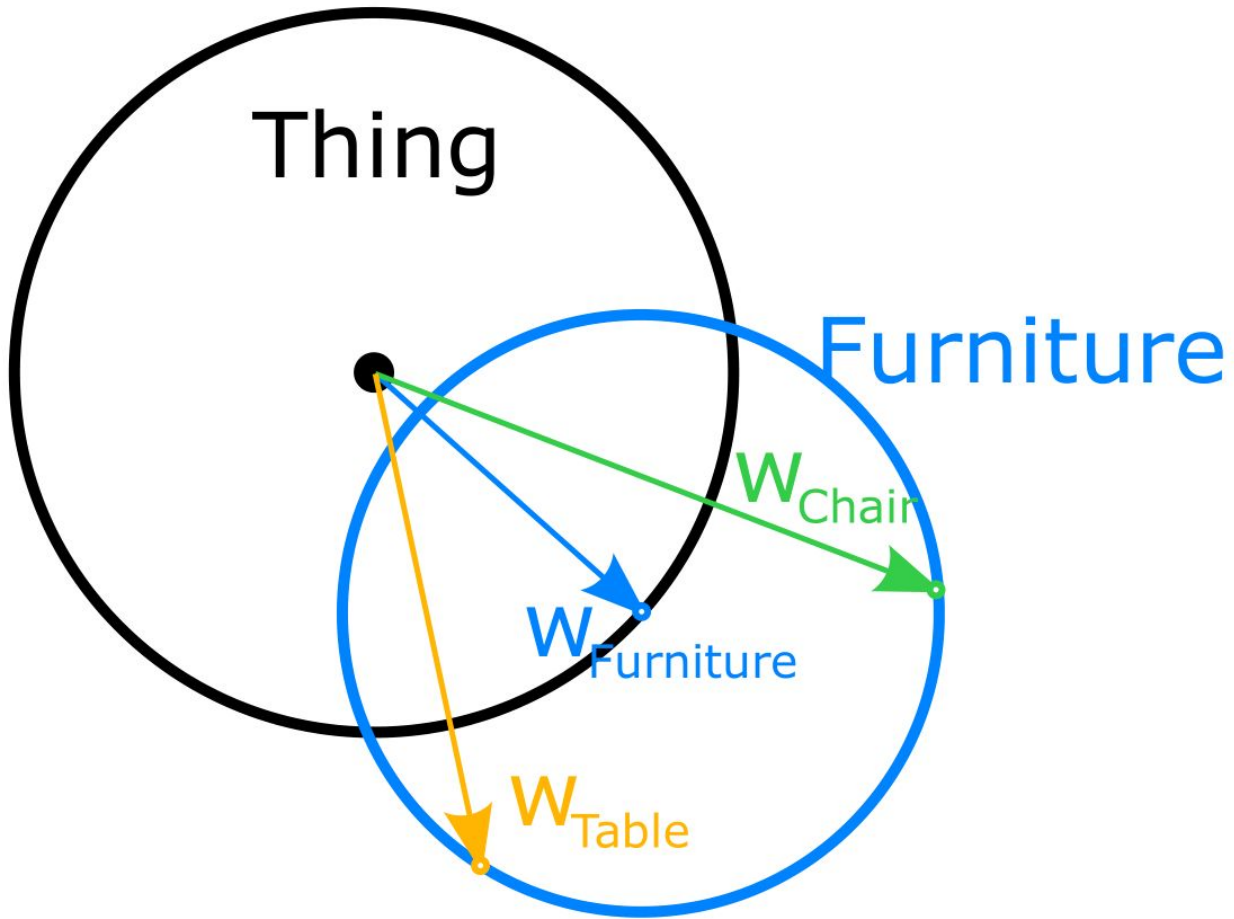
Example: chair and table VS chair and plane

Consequence: two hyperplanes of the same class **point to similar directions**

$$\left\| \frac{w_{\text{chair}}}{\|w_{\text{chair}}\|} - \frac{w_{\text{table}}}{\|w_{\text{table}}\|} \right\| \leq \left\| \frac{w_{\text{chair}}}{\|w_{\text{chair}}\|} - \frac{w_{\text{plane}}}{\|w_{\text{plane}}\|} \right\|$$

Our contribution :

- Build a regularizer *for the last layer only*
- Forces separating hyperplanes of similar classes to be close to each others.



Experimental results

Dataset	Plain network	Our
CUB200	50.91	63.55
Cars	79.85	85.76
Dogs	55.49	65.90

% accuracy on classification problem, Densenet161.

See you at the poster for more!

- Efficient implementation (only matrix multiplications!)
- Impact on the embedding (with awesome figures)
- Ablation study
- Etc..