Pierrick Leroy

Pierrick Leroy is a PhD student at the mathematical department and SmartData at Politecnico di Torino, supervised by prof. Francesco Vaccarino and Giovanni Petri. His current focus is on the application of geometric and topological methods to deep learning, to understand basic blocks more precisely and large architecture more empirically.

Attributes Shape the Embedding Space of Face Recognition Models

ABSTRACT

Face Recognition (FR) tasks have significantly progressed with the advent of Deep Neural Networks, particularly through **margin-based triplet losses** that embed facial images into high-dimensional feature spaces. During training, these contrastive losses focus exclusively on identity information as labels. However, we observe a multiscale geometric structure emerging in the embedding space, influenced by interpretable facial (e.g., hair color) and image attributes (e.g., contrast).

We propose a **geometric approach** to describe the dependence of FR models to these attributes and introduce a physics-inspired alignment metric. We evaluate the proposed metric on **controlled models** and **widely-used FR models**. Our findings reveal that the models exhibit **varying degrees of invariance** across different attributes, enabling deeper interpretability.

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