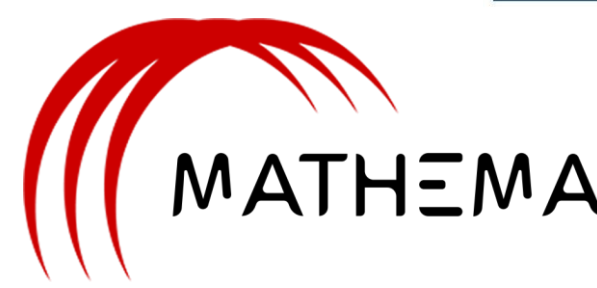




Politecnico
di Torino
Dipartimento
di Automatica e Informatica



PhD in Computer and
Control Engineering
37 cycle



Supervisor
Prof. Tania Cerquitelli
Industrial Supervisor
**Dr. Alessandro Bellini and
Dr. Stefano Cuomo**
(Mathema srl, Firenze, Italy)

Exploring The Latent Space For Machine Learning Applications - Security Challenges

PhD Candidate:

Doaa ALMHAITHAWI

Email: doaa.almhaithawi@polito.it

Introduction

What is the latent space? Latent space refers to an abstract multi-dimensional space that encodes a meaningful internal representation of externally observed events.

Why it is used? Latent space is used in all the domains and for different purposes, the most success is noticed in images, text, voice and videos. To generate new data, extract important features, visualization, anomaly detection and others.

How can it be used? Latent space needs to be build first based on the targeted data, then it will be explored in a way that serves the final purpose.

Method

Build a toy example with a simple model and a controlled environment by using well defined input and output to study the latent space of this model using the existing techniques and to generalize the findings into real world existing and more complex models.

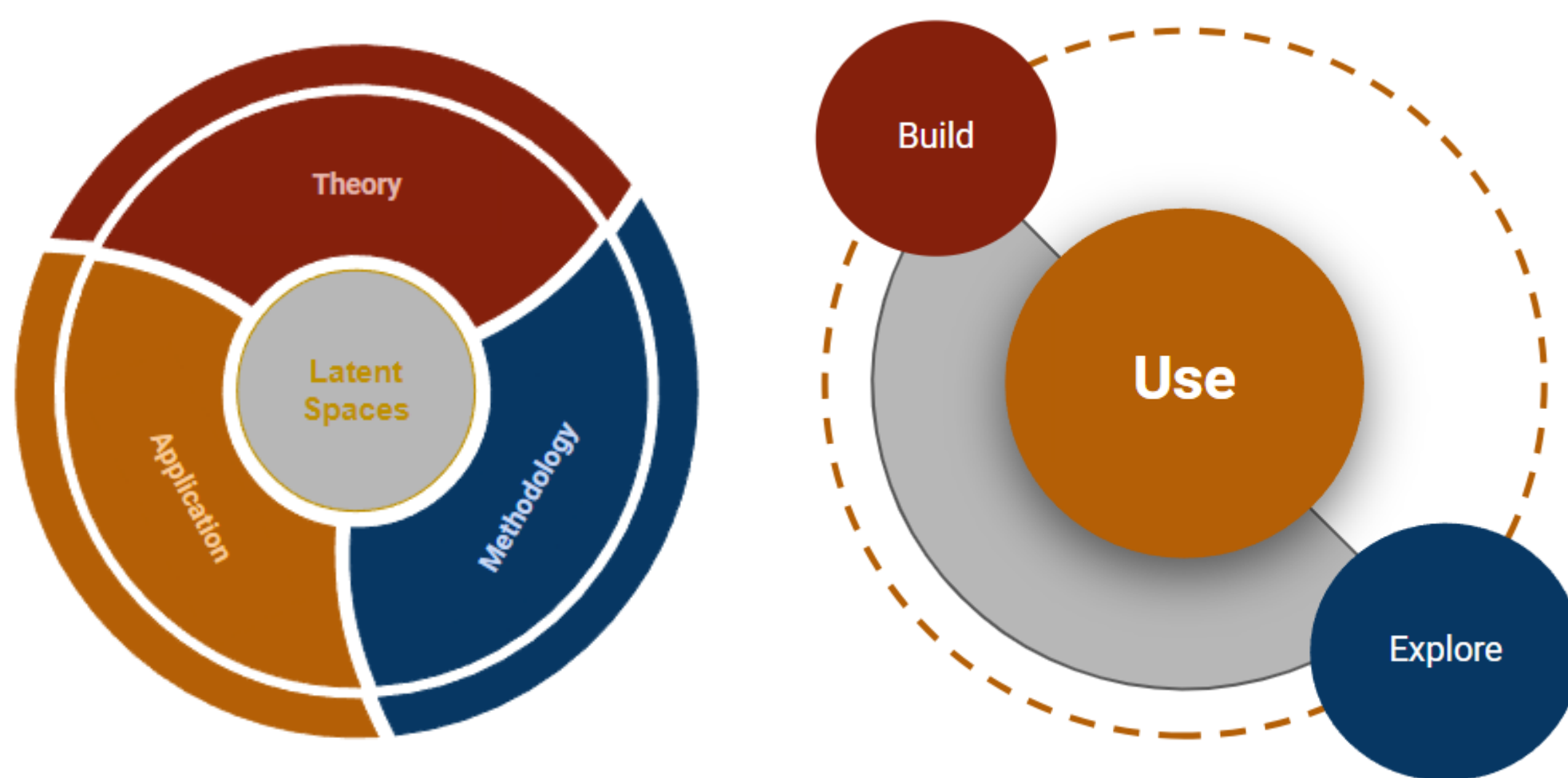
Results

Studying the latent space of an existing model can give some hints about the entanglement of features and latent representation (e.g. DaVinci Face Project developed by Mathema srl with the aim of creating a portrait in a DaVinci style starting from a photo. www.davinciface.com)



Objectives

My Research Paths:



- Theory:** The building of latent spaces as estimation of the real world data to study an estimation of any complex domain, and how much accurate this estimation, what is the limitations of finding an acceptable representation
- Methodology:** Exploring the latent spaces properties which will concern the methods and techniques used in projection, exploration, unfolding, visualization and other processing of data in the original and the latent spaces
- Application:** Generalizing the results in the previous paths to use different datasets from different fields of study

Using a mathematically controlled environment, the Neural Network based model behaviours can be explained and predicted.

Conclusions

Studying the latent spaces of neural network models can provide information about how these models achieve their impressive results. Generalizing this work to more complex models is challenging, but it is a promising starting point.

References

- Almhaithawi, Doaa, Alessandro Bellini, and Stefano Cuomo. "Exploring Latent Space Using a Non-linear Dimensionality Reduction Algorithm for Style Transfer Application." *European Conference on Advances in Databases and Information Systems*. Cham: Springer International Publishing, 2022.
- Almhaithawi, Doaa, et al. "On the Construction of Numerical Models through a Prime Convolutional Approach." *Proceedings of the 33rd European Safety and Reliability Conference (ESREL 2023)*. Research Publishing, Singapore, 2023.

