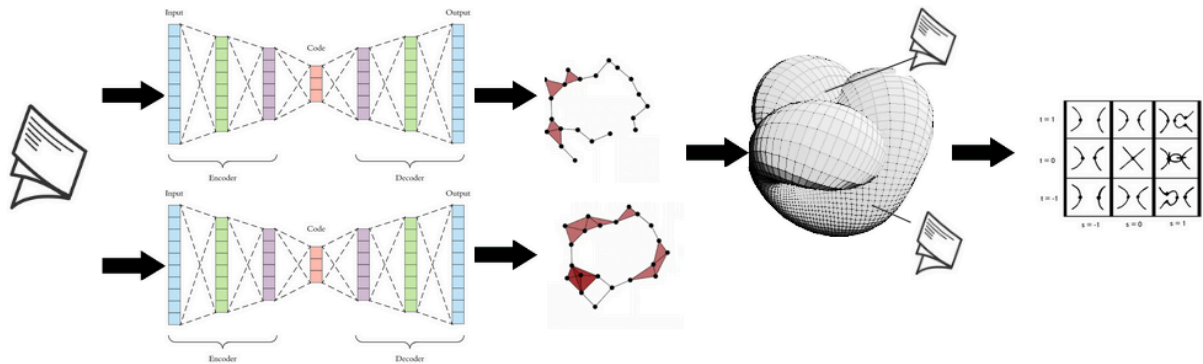


## Application to the Science of Science satellite Towards Explainable Embedding methods of knowledge landscape

In this work, we are developing and applying explainable embedding methods to study collective knowledge landscape patterns. For this we are utilizing low-dimensional embedding techniques, we create a knowledge space composed of scientific articles, as well as patents data. We are comparing methods to analyze multi-dimensional knowledge landscape, considering several embedding methods and dimensionality reduction methods (Figure 1). Our findings offer new ways to represent knowledge evolution, which we compare with methods used in tracking trends in art historical data [3] and extend to study the science of innovation or learning trajectories of people following the evolution of scientific knowledge data.

Furthermore, we extend our methods and concepts through encapsulating methods using explainable embedding methods, hypergraph theory and algebraic geometry methods, which are popular right now within the developing AI paradigms, to process and create statistically testable methods for studying and browsing knowledge space from yet another perspective (Figure 1). This work is the continuation of the work, which has been developed in [1,2].



**Figure 1.** Illustration of the explainable AI methods applicable to a broad range of data (textual, discrete coordinate-form data). We utilize the algebraic geometry and hypergraph theoretical methods [4] to estimate the explainability indices for the embedded data and latent space of the embedding model itself.

## References

- [1] C. Singh, L. Tupikina, M. Starnini, M. Santolini "Charting mobility patterns in the scientific knowledge landscape" Nat.Comms arxiv.org/abs/2302.13054 arxiv, under rev. (2023)
- [2] C. Singh, E. Barme, R. Ward, L. Tupikina, M. Santolini "Quantifying the rise and fall of scientific fields", Plos One 17(6): (2022)
- [3] A. Karjus, M. Canet Solà, T. Ohm, S. E. Ahnert, and M. Schich, "Compression ensembles quantify aesthetic complexity and the evolution of visual art," EPJ Data Science, 12, 21 (2023)
- [4] Zapata-Carratala, C., & Bajaj, U. (in preparation). Introduction to Infrageometry. (2024)

