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Deep Learning on time-variant Product Space

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Deep Learning on time-variant Product Space



ATLAS

DES SYNERGIES PRODUCTIVES

Arnault Pachot
Prague, November 5 2022

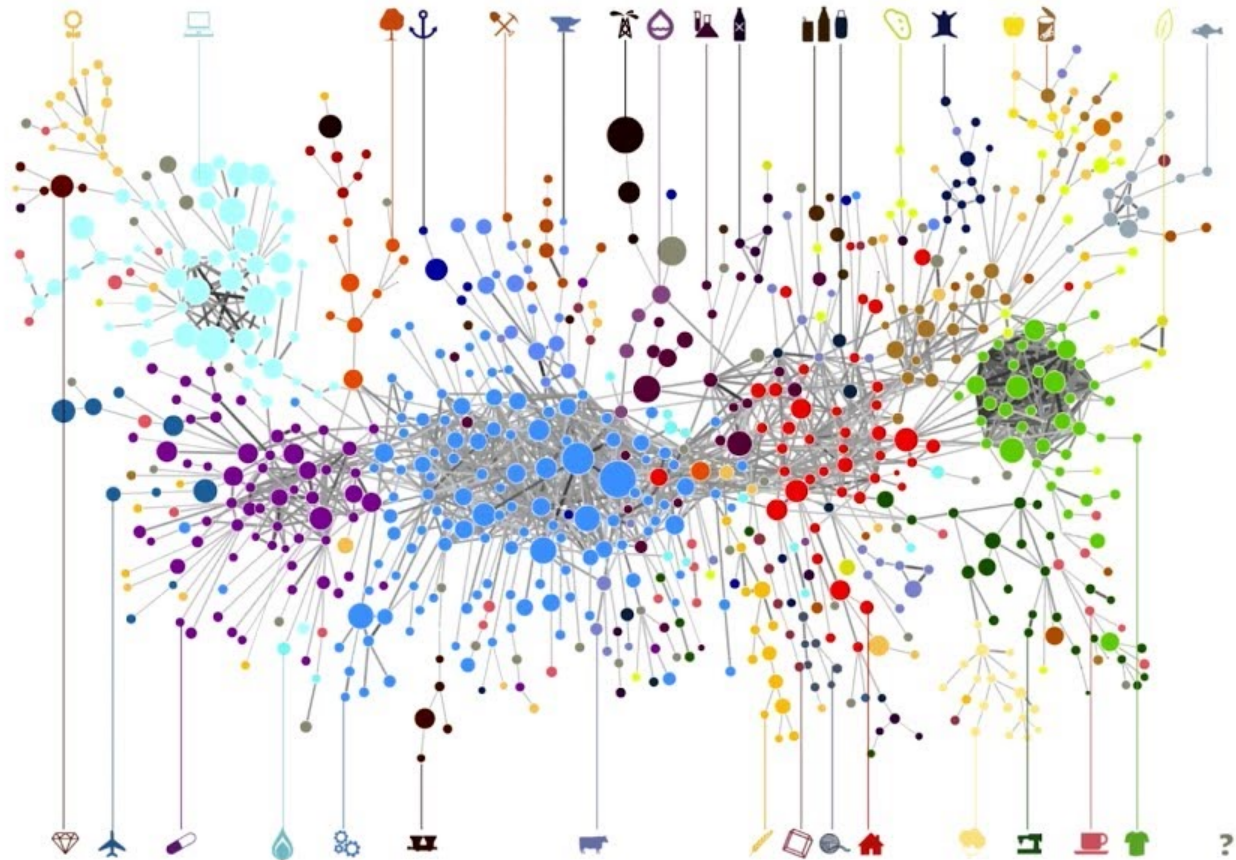


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Objective: use the latest advances in graph learning methods to forecast industrial mutations

Capture the underlying relationships
between product classes **in the Product
Space**

Product Space on 4 digits (1604 products)



We built the Product Space on 6 digits (5040 products)

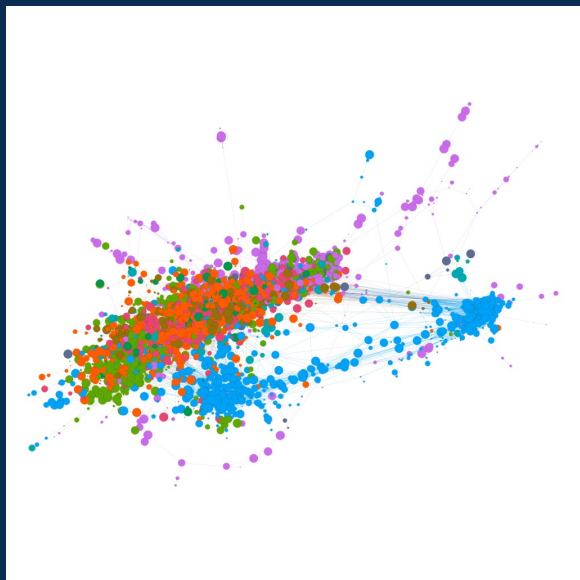


Pachot, A. (2022). *Product Space Networks (6 digits)* [Data set]. Harvard Dataverse.

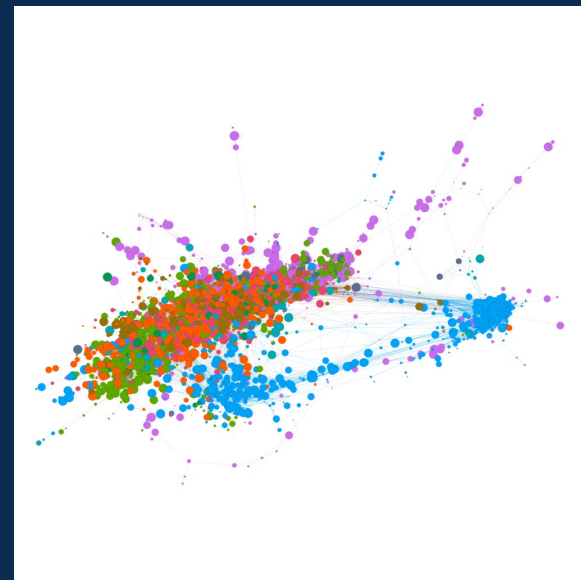
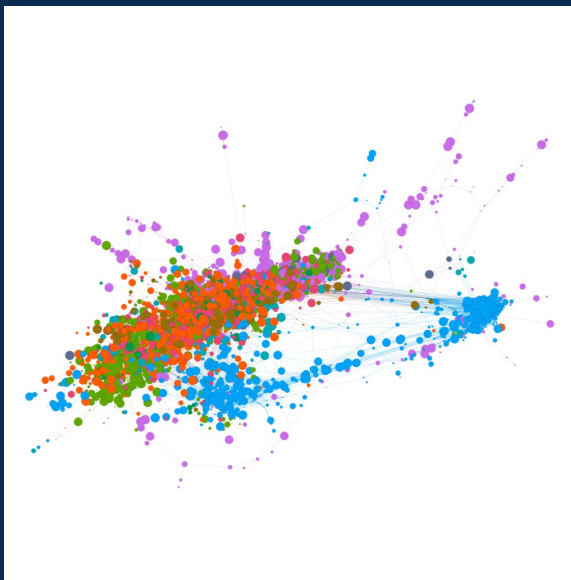
<https://doi.org/10.7910/DVN/T9W75F>

We consider the dynamic Product Space as a discrete-time dynamic graph (DTDG) consisting of a sequence of snapshots from a dynamic graph sampled at regularly-spaced times

We built snapshots of Product Spaces over 25 years for each country



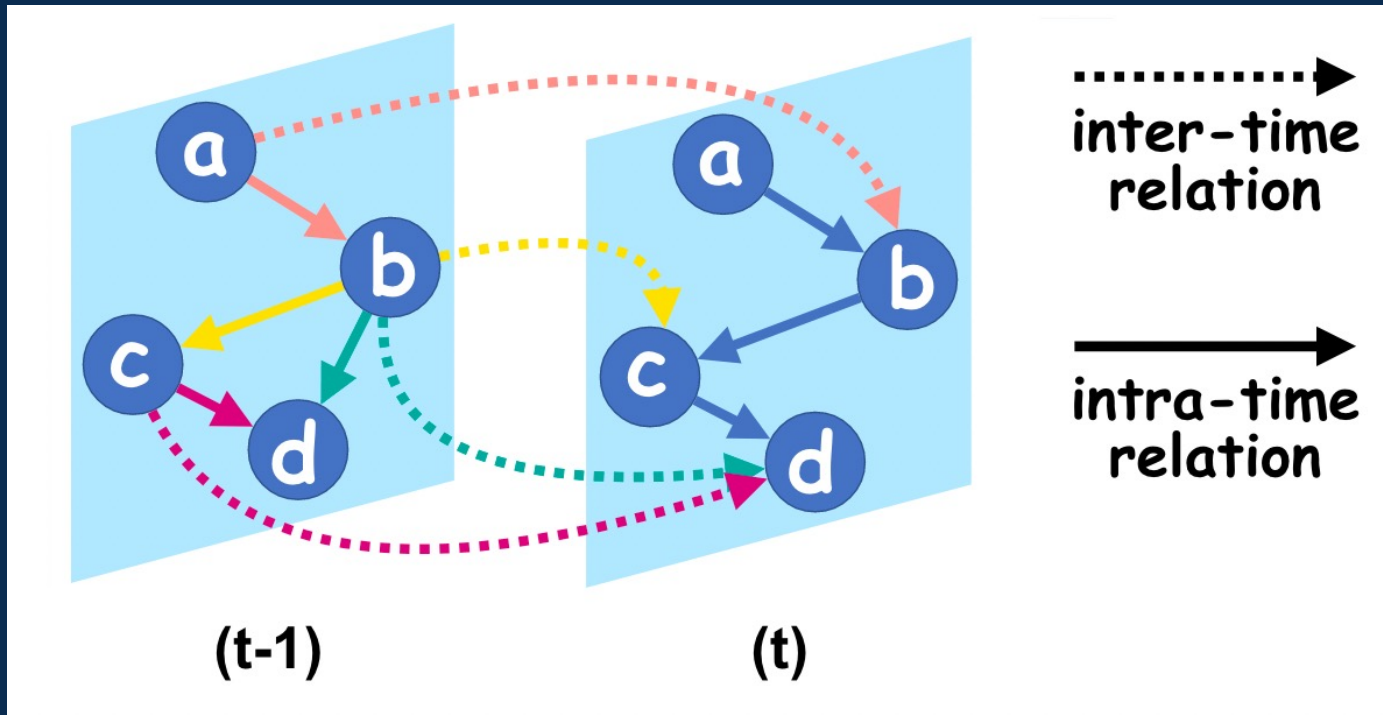
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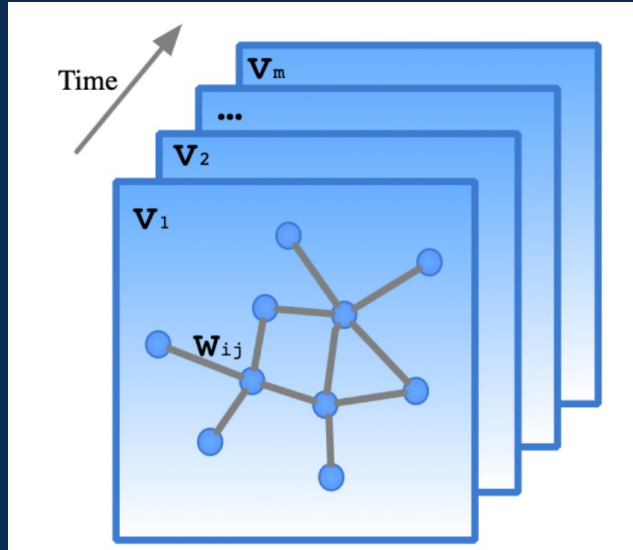


2020

<https://github.com/apachot/Deep-Learning-on-Time-Variant-Product-Space/tree/main/dataset>

Predicting the **Dynamic Embedding Trajectory** in Temporal Networks





Architecture:

Graph Convolutional Network (GCN)
+
Long Short Term Memory (LSTM)

Yu, B., Yin, H., & Zhu, Z. (2018). Spatio-Temporal Graph Convolutional Networks : A Deep Learning Framework for Traffic Forecasting. *Proceedings of the Twenty-Seventh International Joint Conference on Artificial Intelligence*, 3634-3640. <https://doi.org/10.24963/ijcai.2018/505>

Experiments & Results

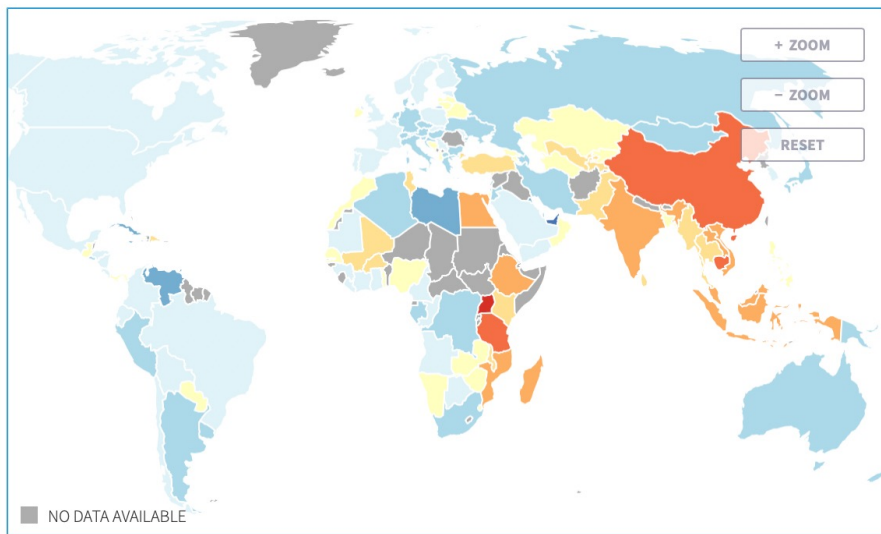
We use the Pytorch Geometric Temporal [library](#)

Source code: https://github.com/apachot/pytorch_geometric_temporal

	Dynamic structure	Temporal features	MSE
Graph Convolutional Network	no	yes	0.045
Long Short Term Memory Relational Graph Convolutional Network	yes	yes	0.022

Conclusions & Perspectives

Growth Projections to 2030 (Annual Growth, %)



- We can predict the evolution of the Product Space of a country using graph learning methods
- Our results must be compared with the growth models proposed by the complexity theory

<https://atlas.cid.harvard.edu/growth-projections>

Thank you !

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https://github.com/apachot/pytorch_geometric_temporal