Astrological prediction for stock market

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Introduction

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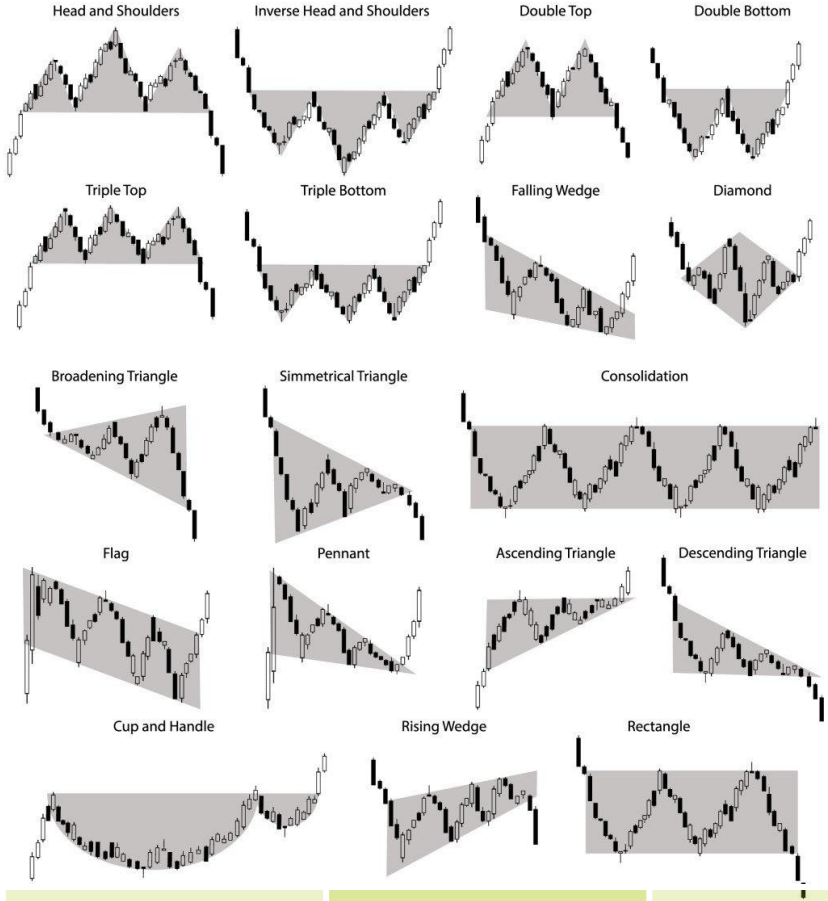
Time Series Analysis can apply **Topological methods** to understand the patterns inside the data.

Why do we need TDA with time series data?

- To **constructing graph** that captures the relationships between data points
- **Persistent homology** identifies **topological structures**, providing insights into the connectedness, holes, and voids present in the data
- Visualize the topological features **to gain insights** into the structure and patterns of the time series data

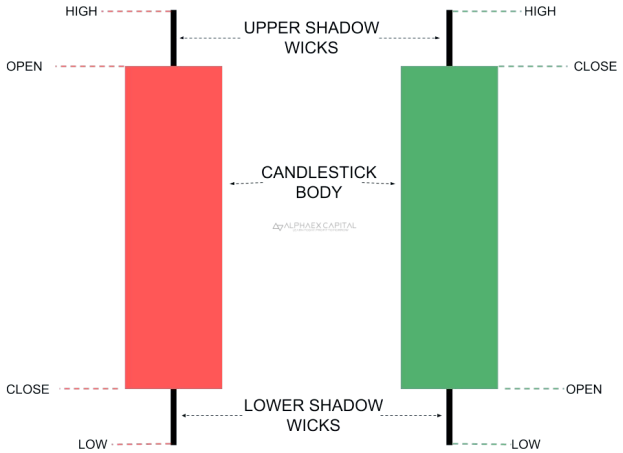
Background

Technical analysis in stock prices



Japanese Candlestick Patterns

The exchange market contains four parameters: open, high, low, and close. These are represented by "**Japanese candles**" in the image (5D points).



Topological data analysis (TDA)

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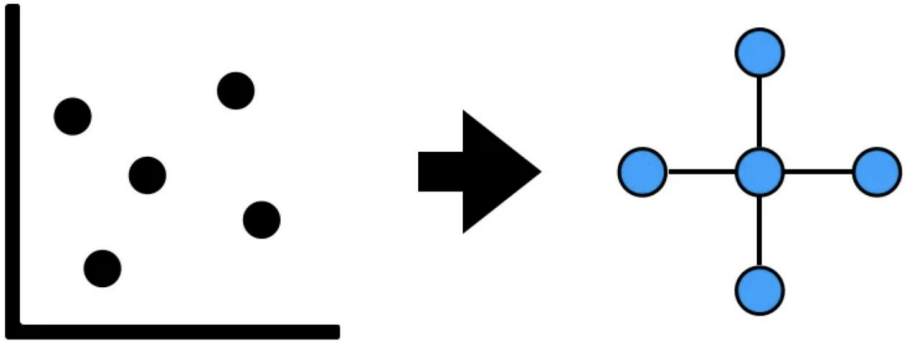
Topological data analysis (TDA) is the tool that looks at the **shape of data**. It consists of various approaches with an underlying theme of extracting structure from unstructured data.



Data → Shape. The basic idea of TDA is to extract shape from data

https://towardsdatascience.com/topological-data-analysis-tda-b7f9b770c951

Persistent Homology

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Measuring topological characteristics of shapes and functions is referred to as **persistent homology**. It turns data into simplicial complexes and describes the topology of a space at various spatial resolutions.

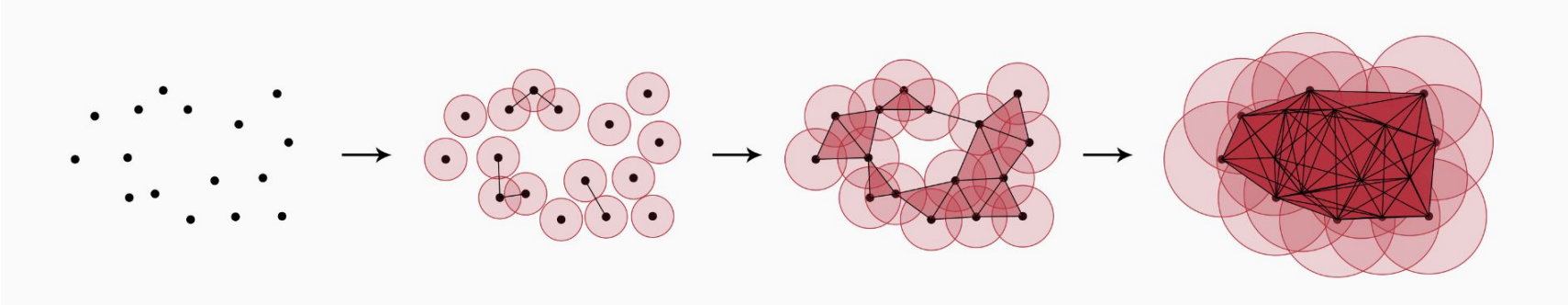

Figure : The filtration process applied to a 2-dimensional point cloud.

https://christian.bock.ml/posts/persistent_homology/

Methods

Our Method

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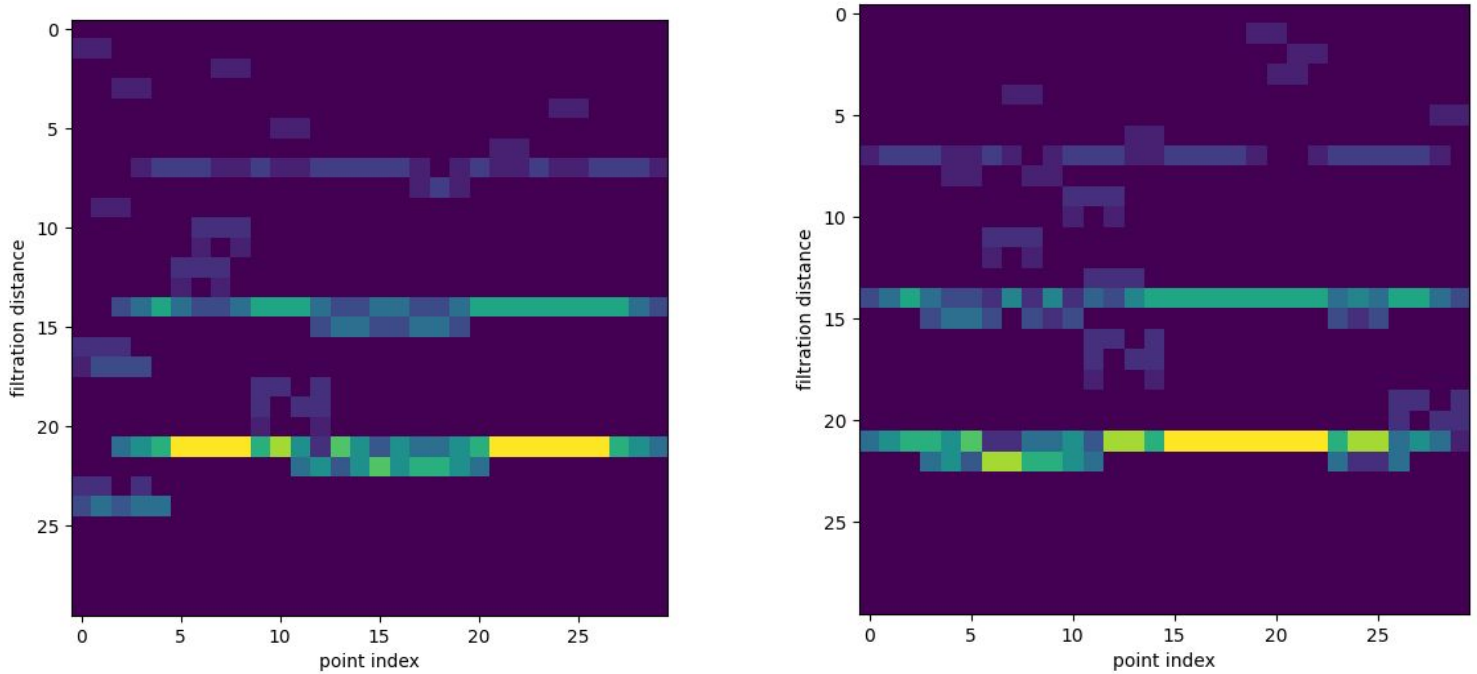
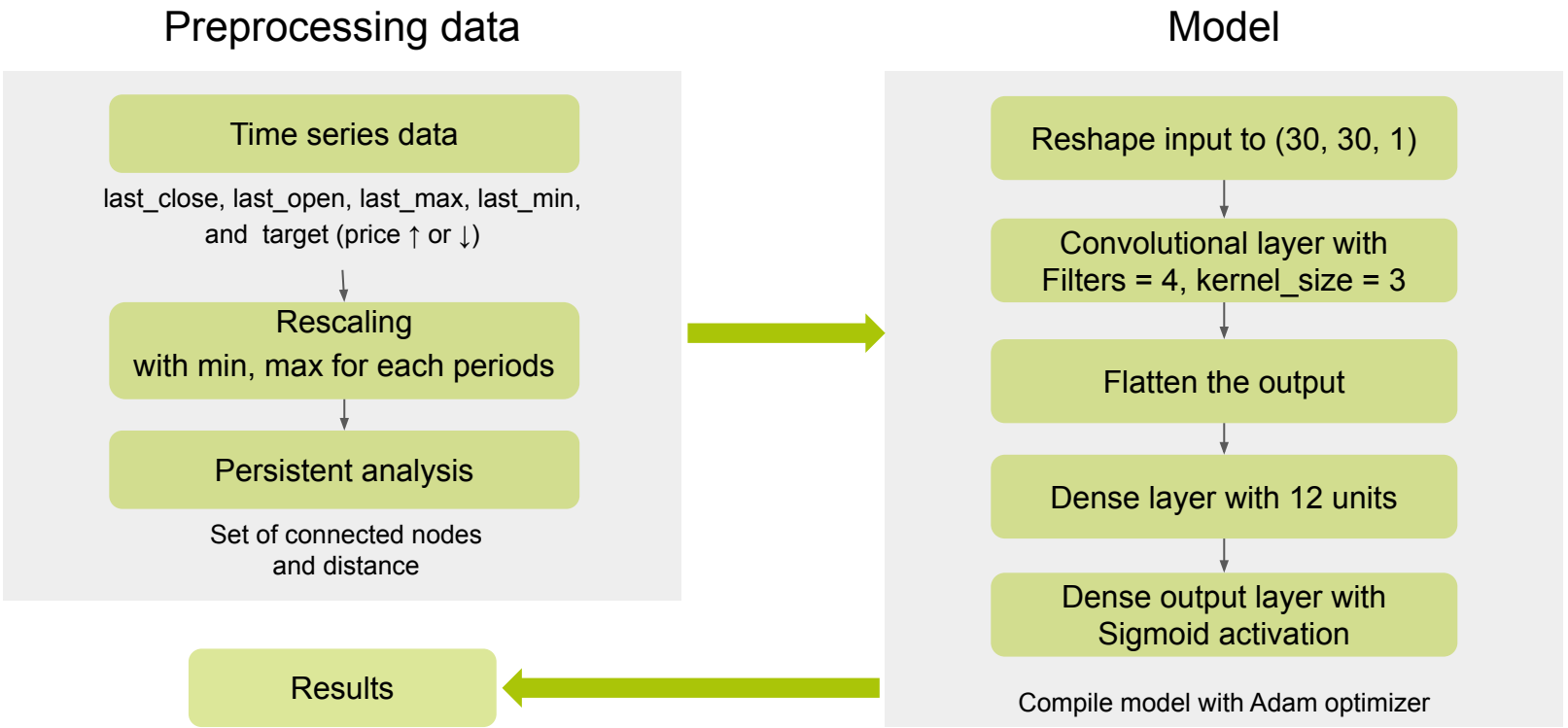
Filtration distance of each point index (window=30)



Here the intensity represents the order of simplex formed. The max order used was 1.

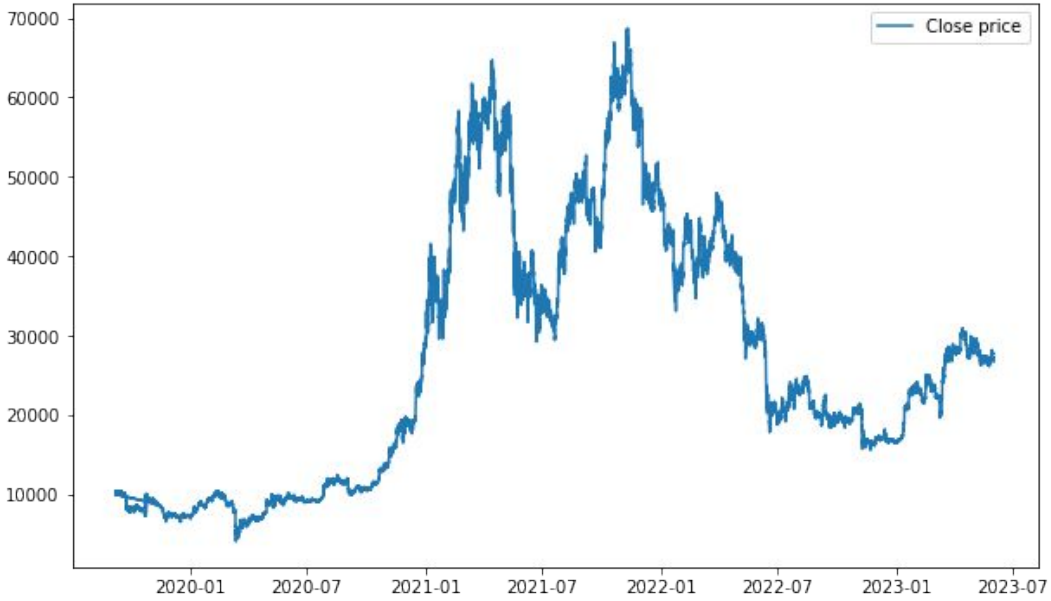
Our method


Preprocessing data
Time series data
last_close, last_open, last_max, last_min, and target (price ↑ or ↓)
Rescaling with min, max for each periods
Persistent analysis
Set of connected nodes and distance
Model
Reshape input to (30, 30, 1)
Convolutional layer with Filters = 4, kernel_size = 3
Flatten the output
Dense layer with 12 units
Dense output layer with Sigmoid activation
Compile model with Adam optimizer
Results

Results

Results

Stock: BTCUSDT price from 2019-09-08 to 2023-06-01



Results

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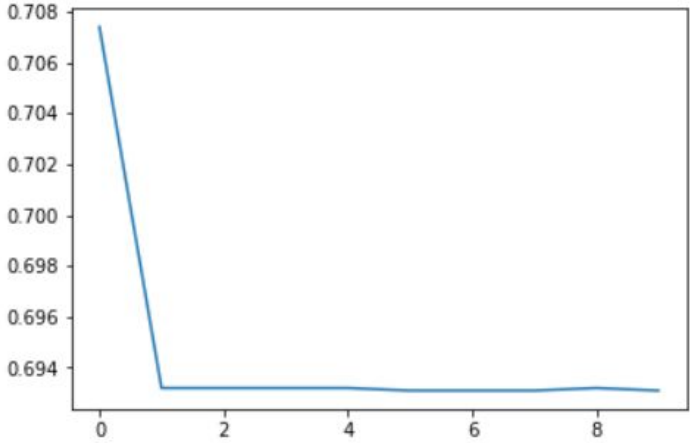
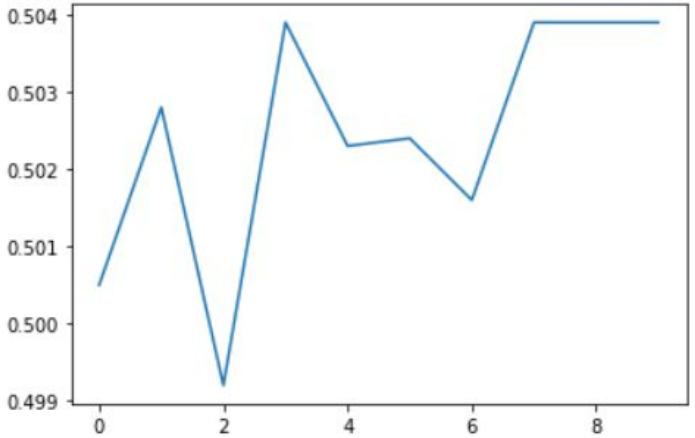
Loss of model (10 epochs)



Accuracy of model (10 epochs)



Model	Accuracy
Our method	0.5135

Source code: https://github.com/ArtemChuprov/TopologicalProject/blob/main/main.ipynb

Conclusion

Conclusion

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Topological Data Analysis (TDA) can provide valuable insights by applying TDA techniques to time series data, we **gain a deeper understanding** of the underlying structure and patterns and TDA can **improve time series prediction** with predictive models by using a **convolutional neural network (CNN).**

Although our test accuracy may seem poor, for stock market this is a result. As long as test data contained **about 4000 hour time steps**, our result is statistically significant and may mean that this technique has predictive power.

References

https://github.com/SamirMoustafa/Time-Series-Classification
https://arxiv.org/pdf/1909.10604.pdf
https://giotto-ai.github.io/gtda-docs/0.3.0/notebooks/time_series_classification.html

Thank You!

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