Predicting the FTSO Consensus Price

A Machine Learning Approach

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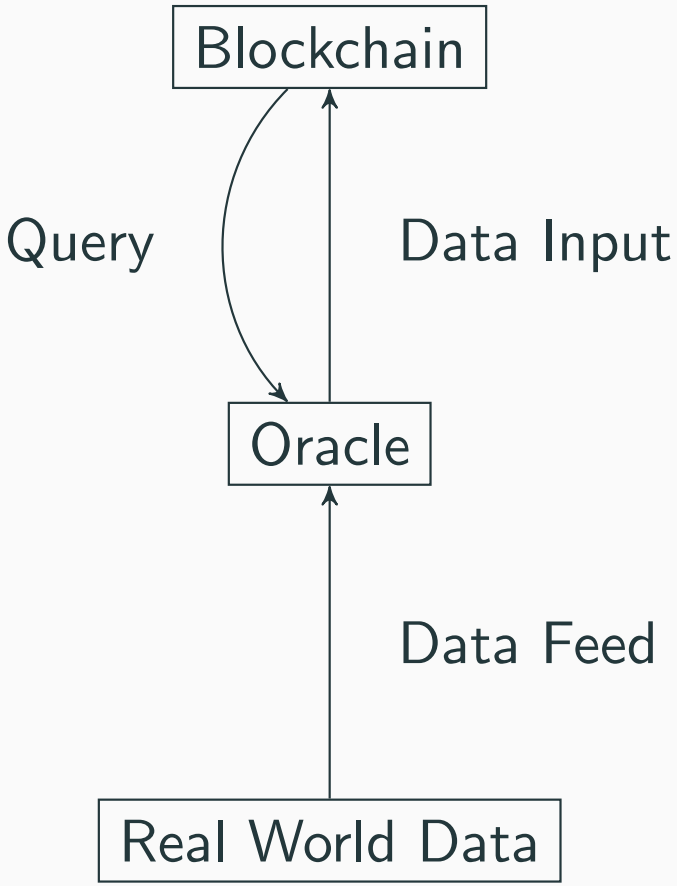
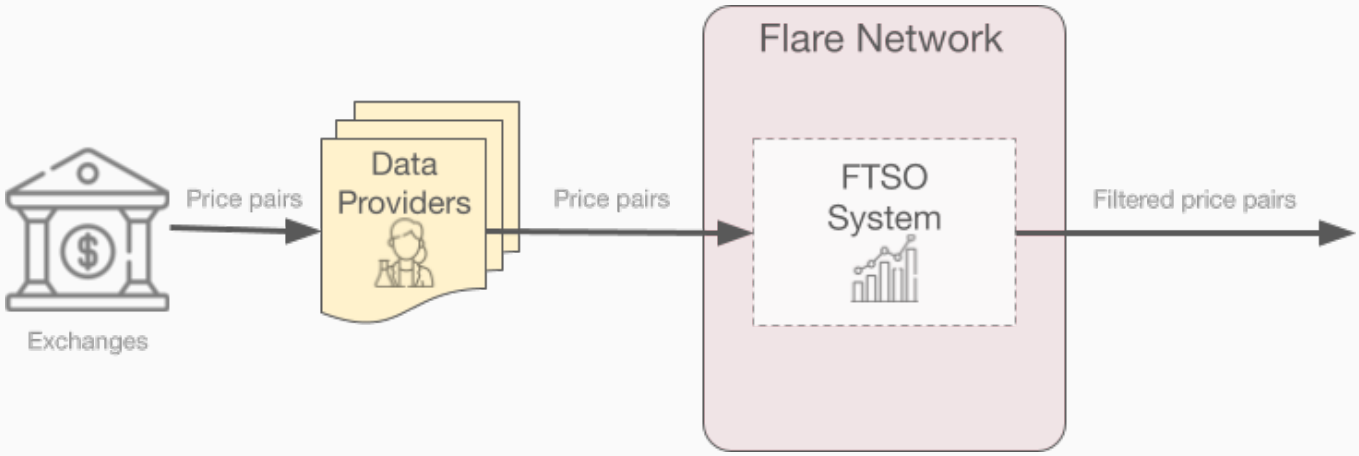
External Prices Consensus



Decentralised Approach to Solving the Oracle problem

FTSO: A decentralized approach to solving the oracle problem



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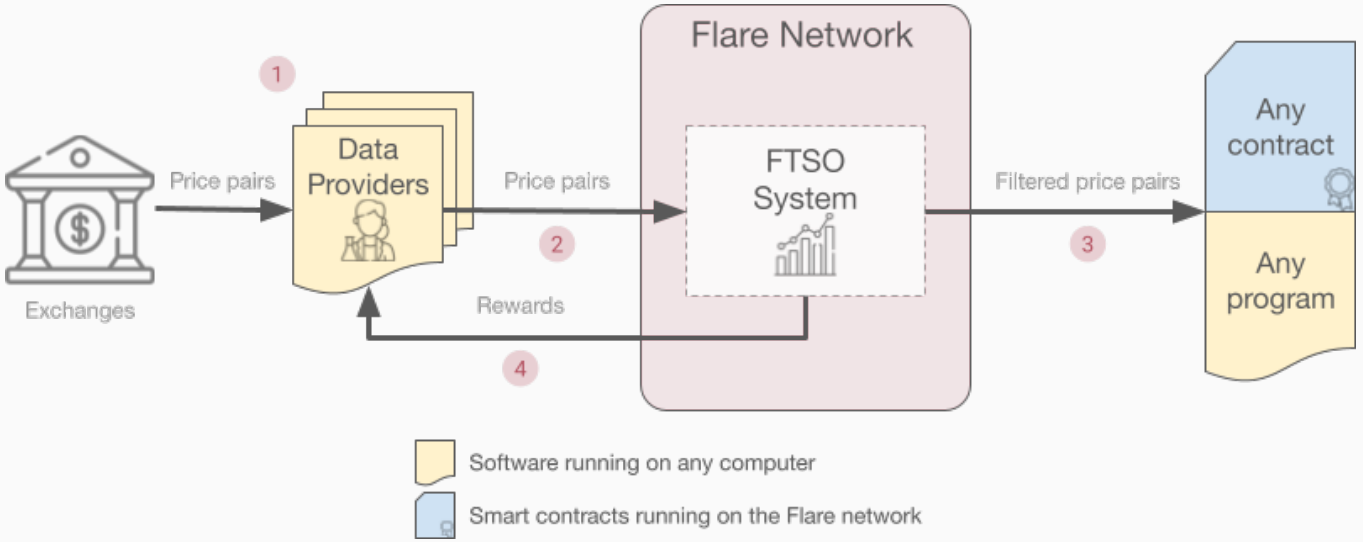
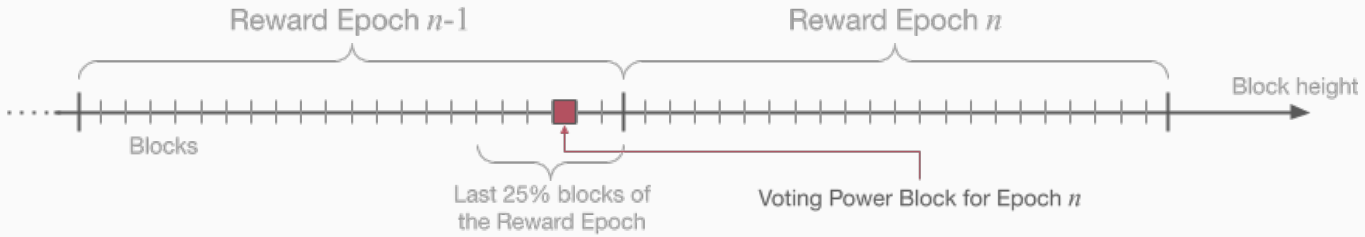


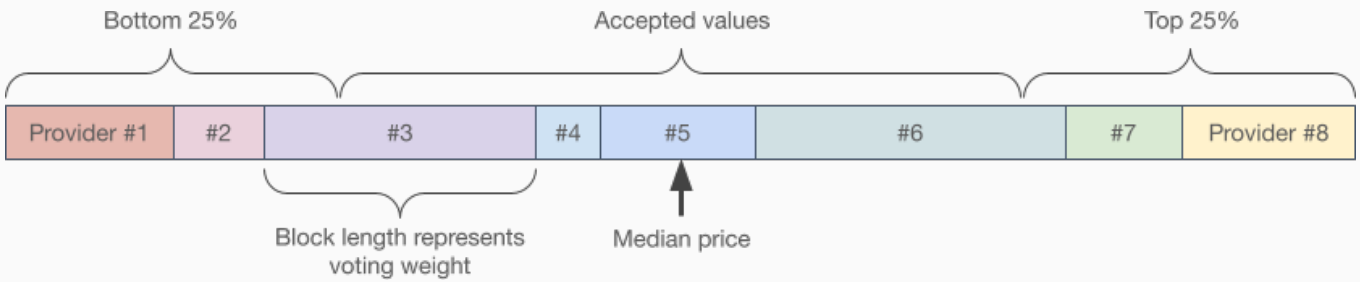
Epochs

Epoch every 180 seconds, reveal 90 seconds after the end of the epoch



Outline of the Problem

- **Dataset:**
  - Past FTSO prices of every coin
  - Current prices on exchanges
- **Target:** Median of the FTSO providers



Smoothing Techniques

Exponential Moving Average (EMA)

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Applies a polynomial regression (of degree k) to a window of n points with least squares optimization.

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FFT Smoothing

- Apply Fast Fourier Transform to convert to frequency domain.
- Remove high-frequency components.
- Inverse FFT to convert back to time domain.

Prediction mechanism

Quantities involved:

- m epochs
- price matrix $E \in \mathbb{R}^{m \times n}$
- Weight contribution vector for each exchange: $\mathbf{v} \in \mathbb{R}^n$

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Overdetermined system $\mathbf{E} \cdot \mathbf{v} = \mathbf{p}$

Pseudocode for Prediction Mechanism

Algorithm 1 Prediction Mechanism

```
for each exchange do
    for each smoothing method do
        Define upper and lower range for parameters
        Specify step size
    end for
end for
Compute cartesian product of all parameter sets
for each combination in cartesian product do
    Smooth the data
    Train the model and calculate optimal solution vector v
    Evaluate accuracy against test data
end for
Identify best-performing model configuration
```

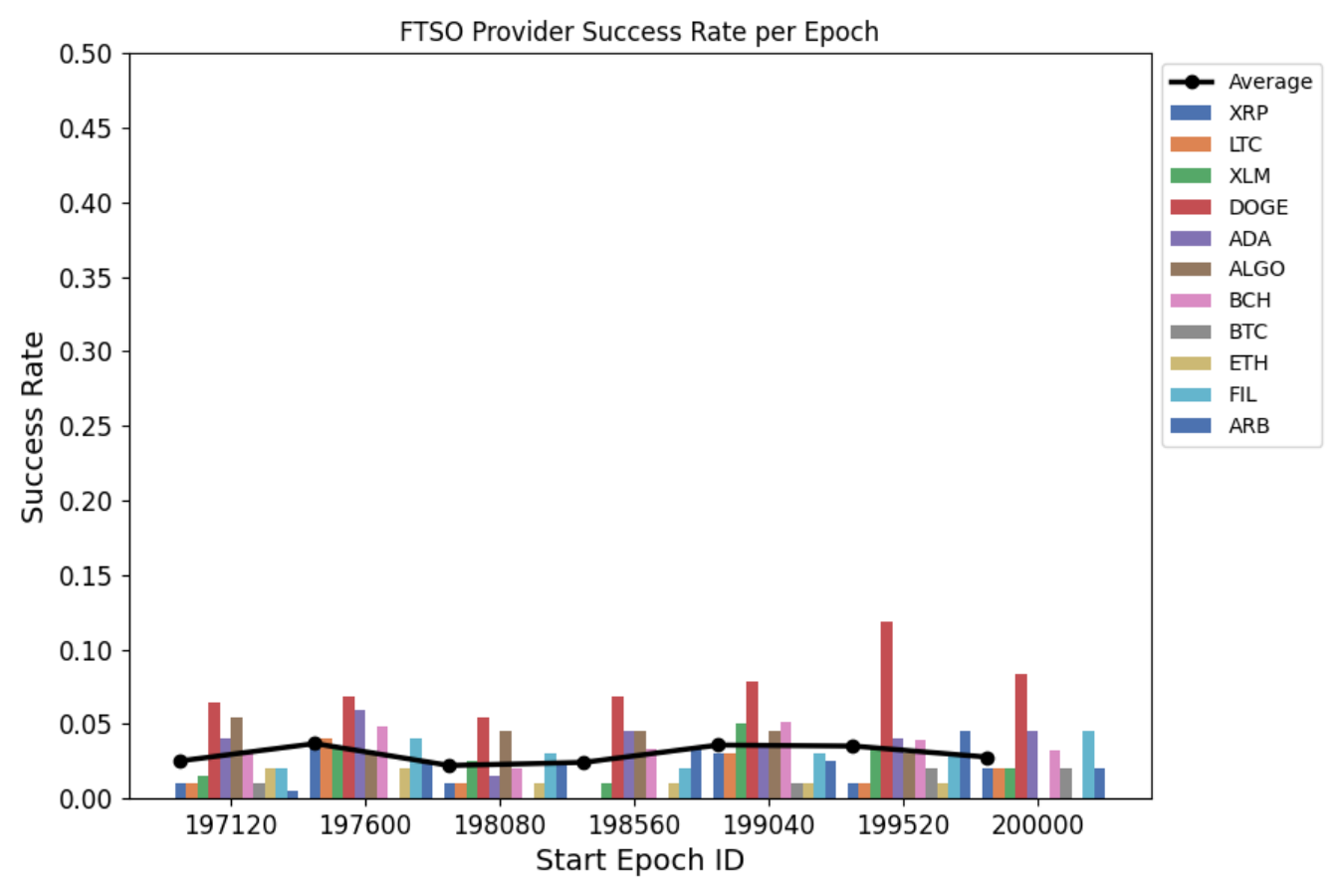
Prediction

Evaluate the performance of our model against the following methods:

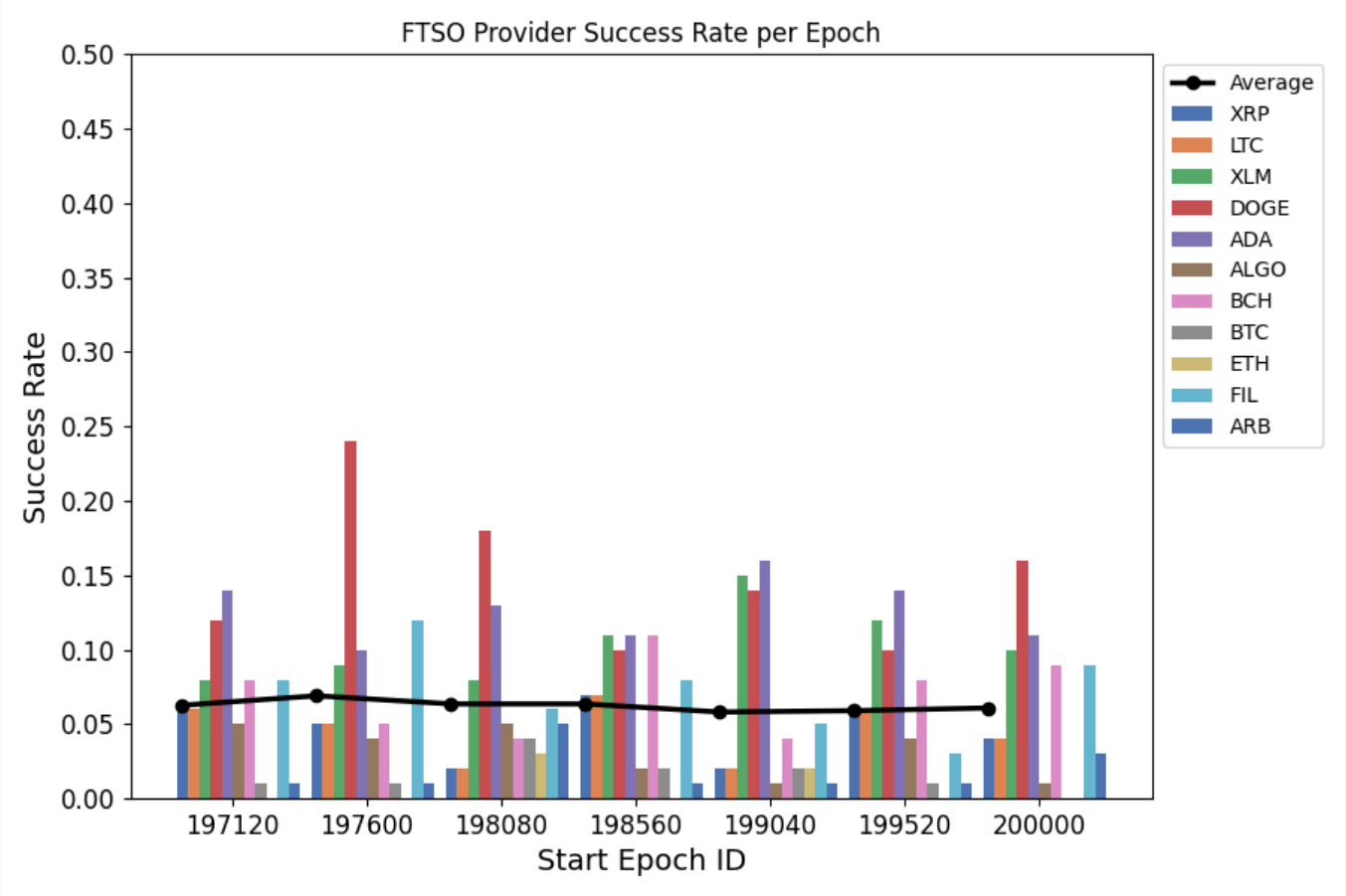
- **Last seen value** method
- **Previous epoch value** method
- **Overdetermined system without smoothings**

Training on 160 epochs, validation against subsequent 160 epochs

Last Seen Value Method

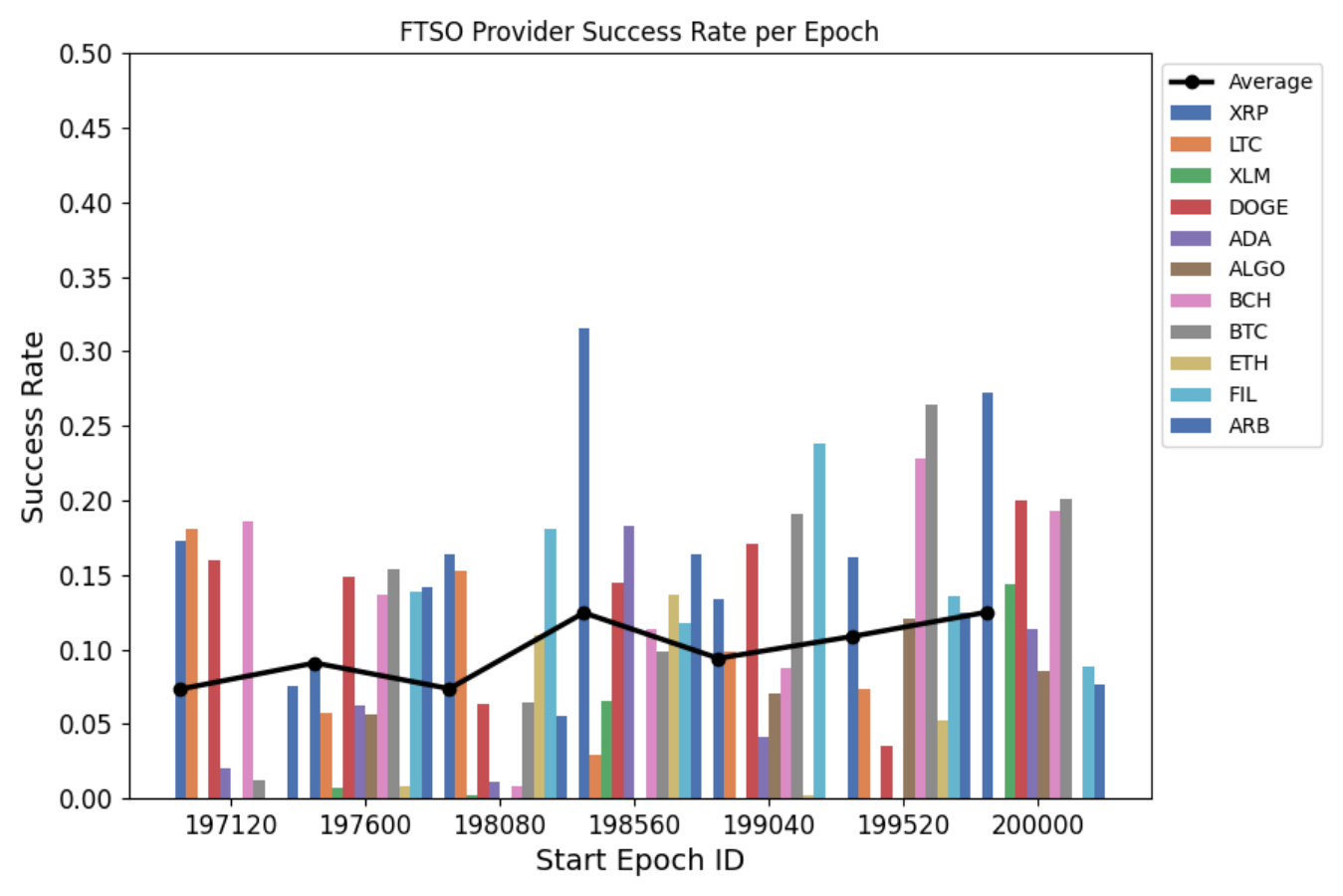


Previous Epoch Value Method

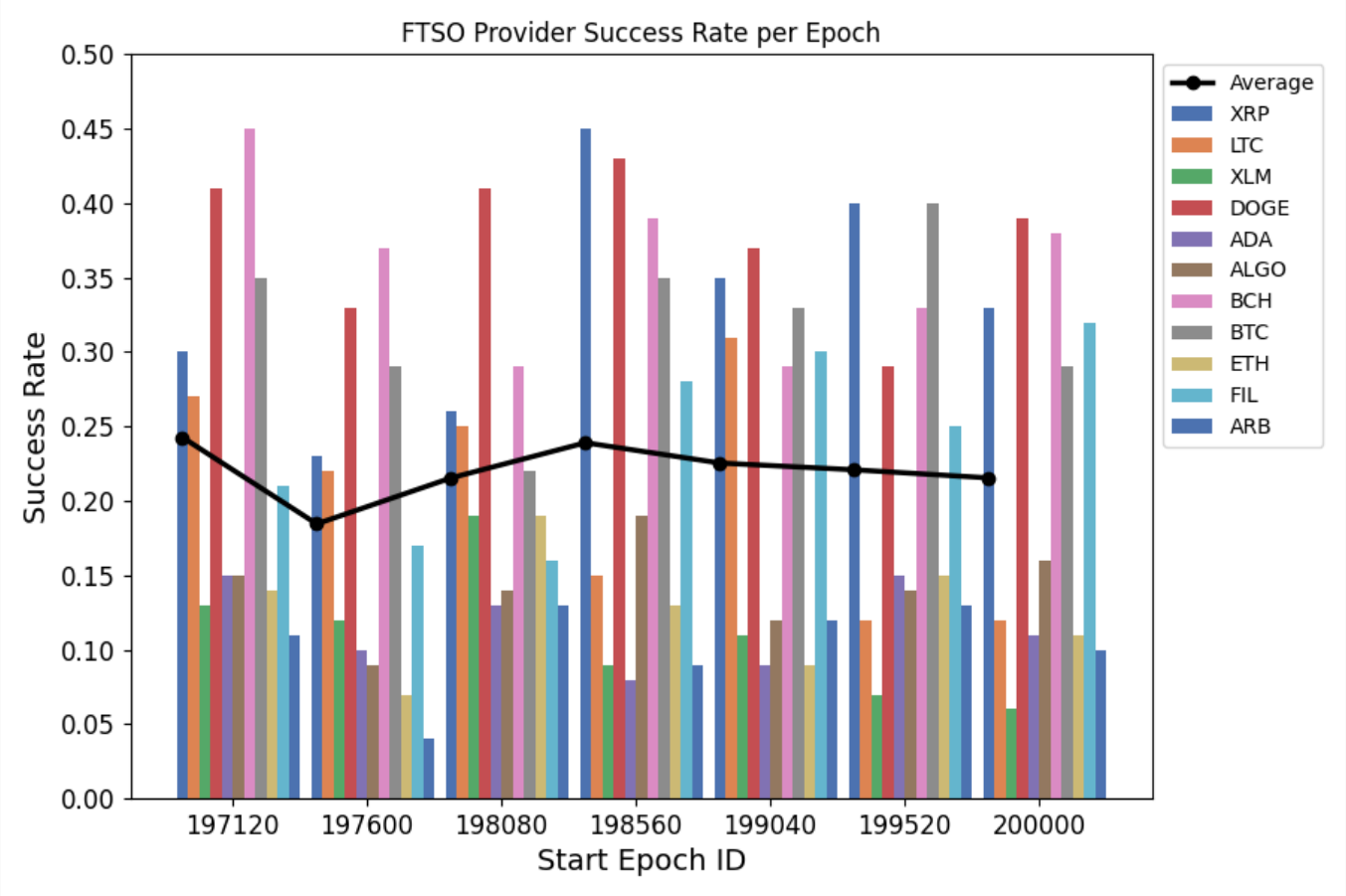


Notable mentions: *ETH*, *FIL*, *DOGE*

Training an Overdetermined System Without Data Smoothing



Training an Overdetermined System With Data Smoothing



Notable mentions: *XRP*, *DOGE*, *BTC*, *XLM*, *ADA*, *ARB*

RMSE

Coin	Last Seen	Prev. Ep	No smoth	Smooth
XRP	0.07412964	0.01536945	0.00542317	0.00398449
LTC	0.07412961	0.01536940	0.00735026	0.00401269
XLM	0.00010802	0.00025230	0.00090994	0.00025548
DOGE	0.00004626	0.00001359	0.00000733	0.00000641
ADA	0.00000201	0.00000395	0.00000183	0.00000174
ALGO	0.00011186	0.00000559	0.00000351	0.00000379
BCH	1.47382928	0.00013239	0.00000828	0.00000565
BTC	23.78687273	5.01065648	1.94068887	0.91171693
ETH	1.50008731	0.54618855	0.18091784	0.05930725
FIL	0.00360921	0.00079709	0.00039865	0.00040482
ARB	0.00098386	0.00025156	0.00015229	0.00014042

Further Research Suggestions

- Improvement of low performing coins
- Deep learning approaches towards time series data and combining it with simpler approaches

References

[1] Giulio Caldarelli. "Overview of Blockchain Oracle Research". In: *MDPI* 14.6 (2022), p. 175.

[2] Giulio Caldarelli. "Understanding the Blockchain Oracle Problem: A Call for Action". In: 11.11 (2023), p. 509.

[3] Vasant Dhar. "Data Science and Prediction". In: *Communications of the ACM* 56.12 (2013), pp. 64–73. URL: https://dl.acm.org/doi/abs/10.1145/2500499.