Tech Giants Face-Off:

AI Companies vs.
S&P 500 and Dow Jones

Do AI stocks have higher profits with lower risks?

Objective

This presentation provides a comparative analysis of daily and cumulative returns, as well as volatility (risks), of the top 10 AI companies' stocks with the S&P 500 and Dow Jones indices for the last 5 years.

Hypothesis: Question, Null, & Alt

Question

Does the growth of AI stocks in the last 5 years suggest that investing in these companies is significantly more profitable than investing in most other companies based on the market indices?

If-Then

If I invest in the top AI companies, then I will see better profit compared to the market indices, because there is a significant difference in the growth of these stocks and the market indices.

Null Hypothesis

There is no significant difference between the growth of AI stocks and the market indices, as determined by average daily return year over year from 2019-2024, as compared to the S&P 500 or DOW.

Alt Hypothesis

There is a significant difference between the growth of AI stocks and the market indices as determined by average daily return year over year from 2019-2024, as compared to S&P 500 or DOW.

Data Description

Data Obtained

List what data sets are used and where we got them from

- Top 10 AI companies kaggle dataset 1990 through present as selected by Forbes
- S&P 500 and Dow Jones index ETF funds gathered through alphavantage.co API

Data Details

Datasets contained columns: Symbol, date, open, high, low, close, volume, adjusted

Derived Variables

Cleaning done on columns to align datasets, data types correction, and filtered for last 5 years

Daily returns and cumulative returns generated as decimal

Volatility calculated as standard deviation of returns

Data grouped by stock symbol and year

Stock Performance Analysis

Analyzing stock performance involves multiple factors. In this project, we used a simplified approach based on parameters such as average stock prices, daily and cumulative returns, and volatility.

Basics:

- **Daily and Cumulative Returns**: Indicators of a stock's performance over specific periods.
- **Volatility (Standard Deviation)**: Measures stock risk. Higher deviation indicates higher risk.
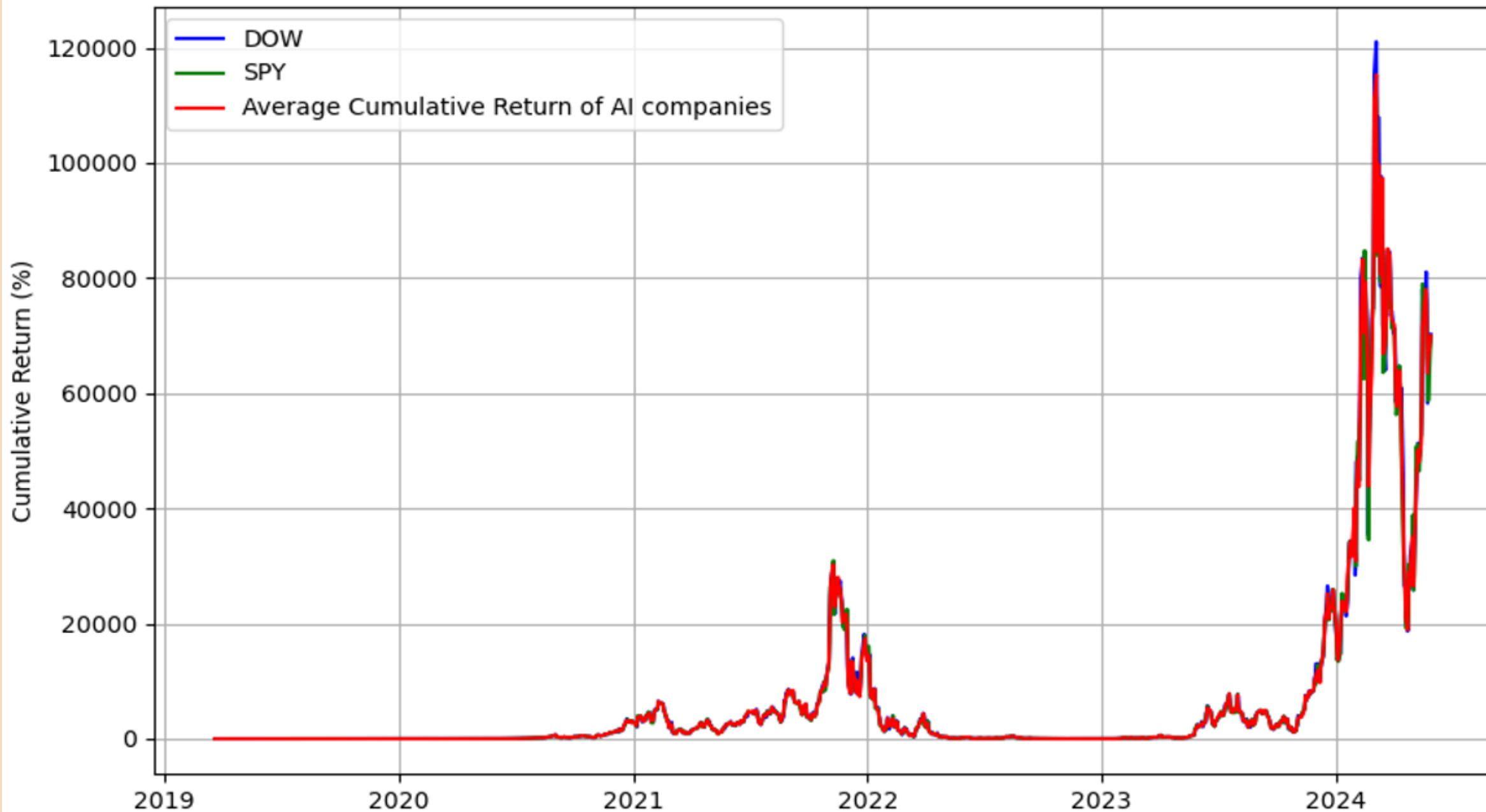
Risk Levels Based on Standard Deviation (STD):

- Low risk: < 10% STD
- Medium risk: 10% ≤ STD < 20%
- High risk: ≥ 20% STD

Now, let's move on to the graphs that illustrate these concepts in the context of our analysis.
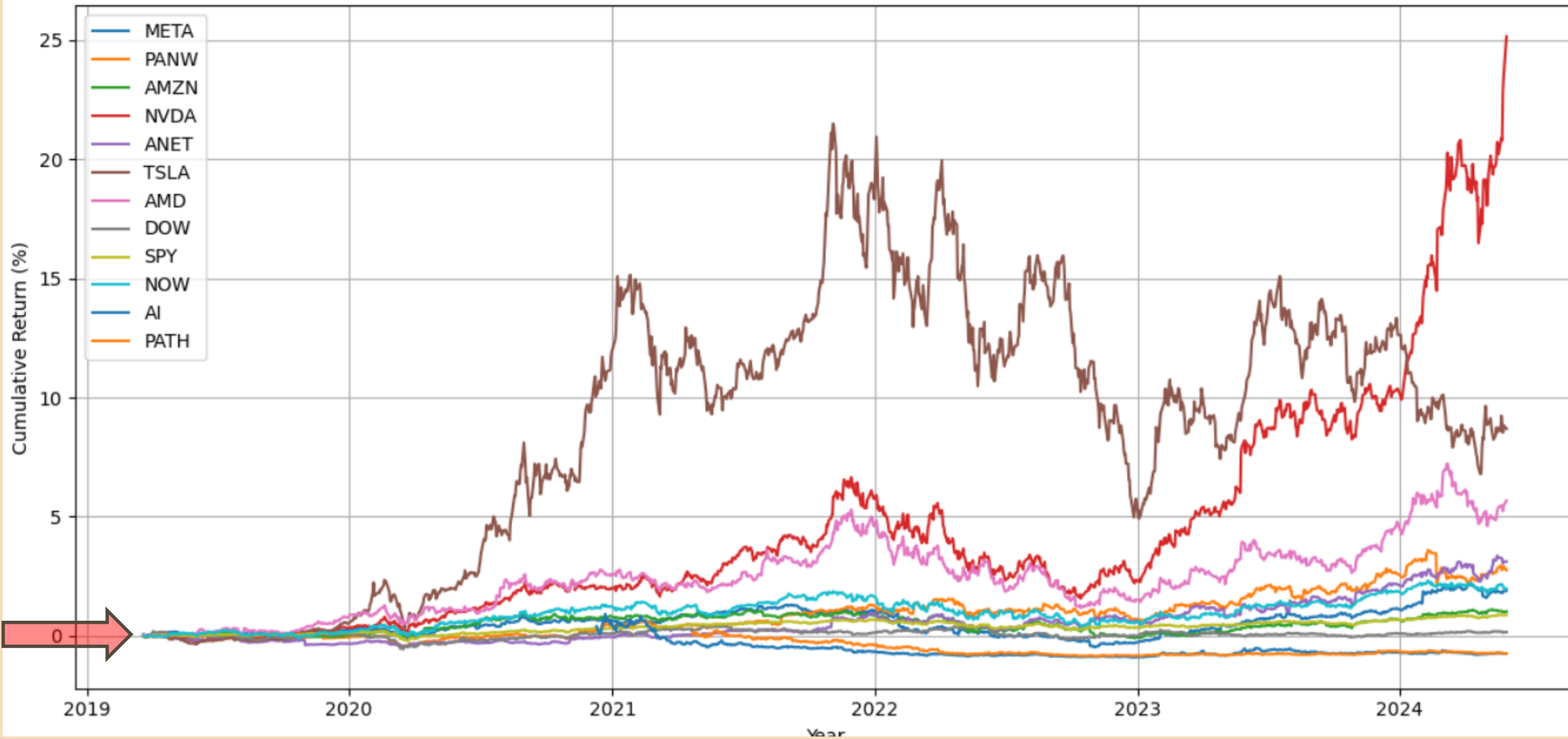
Average Cumulative Return for 2019-2024

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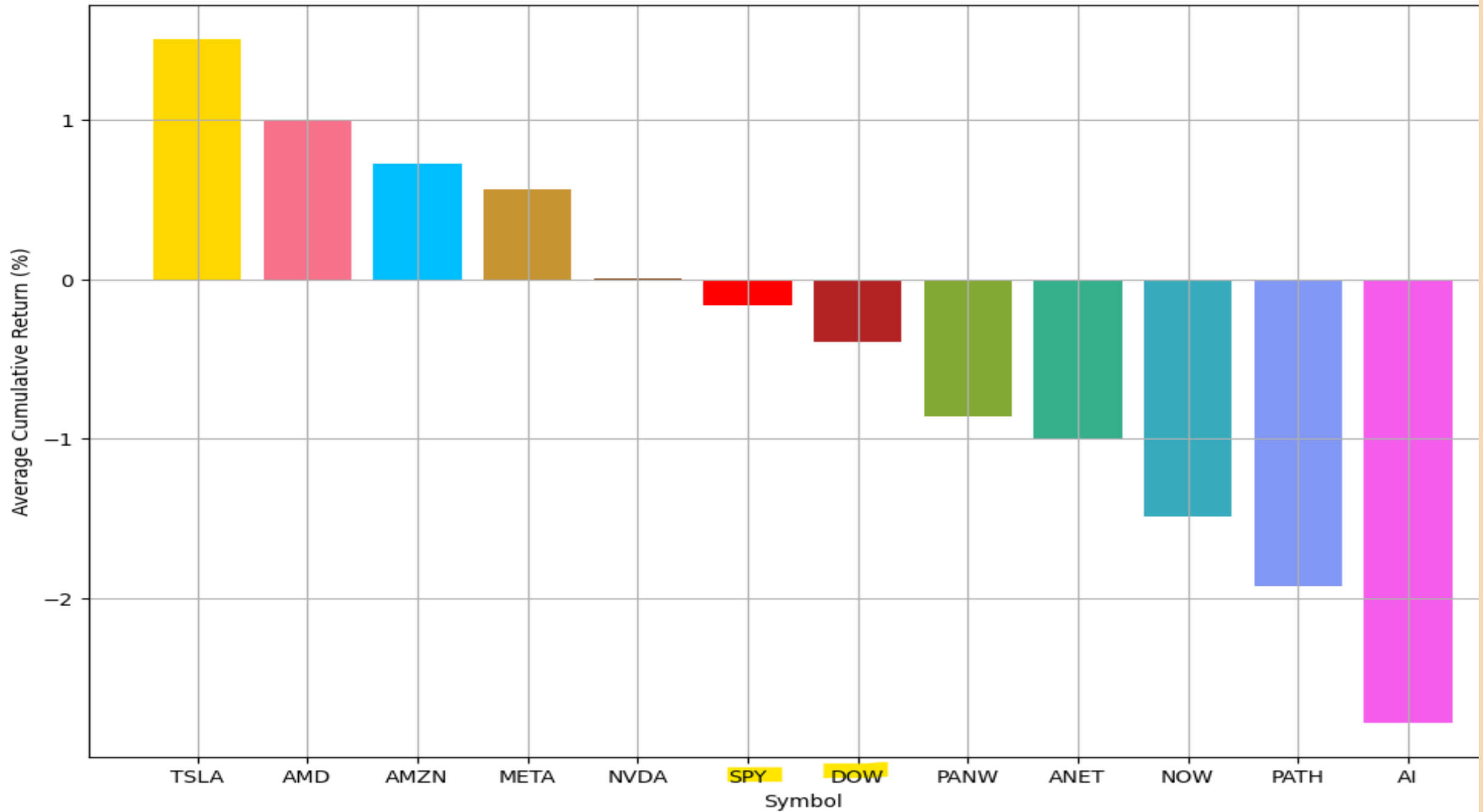
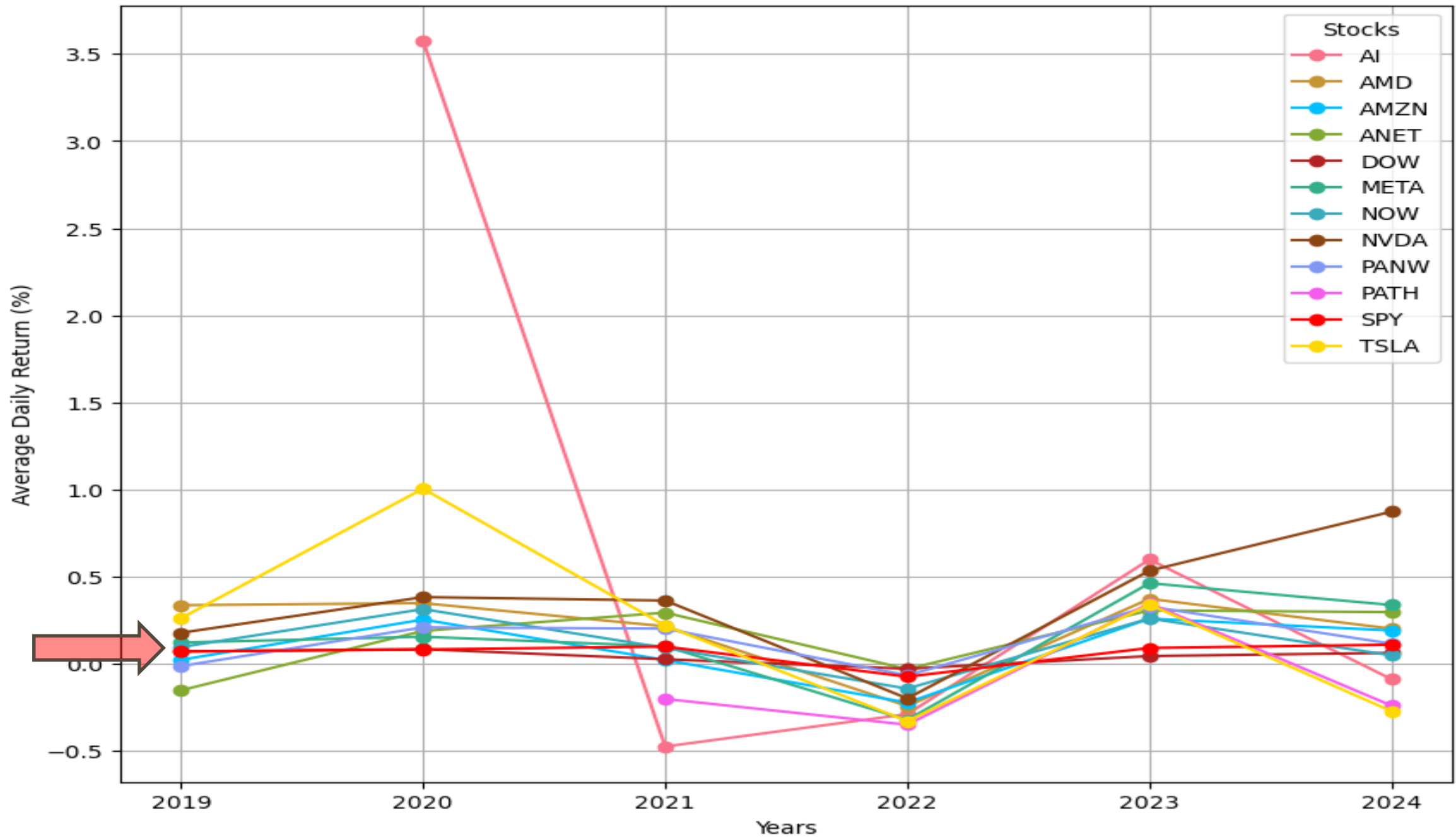Cumulative Returns Comparison between average of AI companies, S&P 500, and Dow Jones

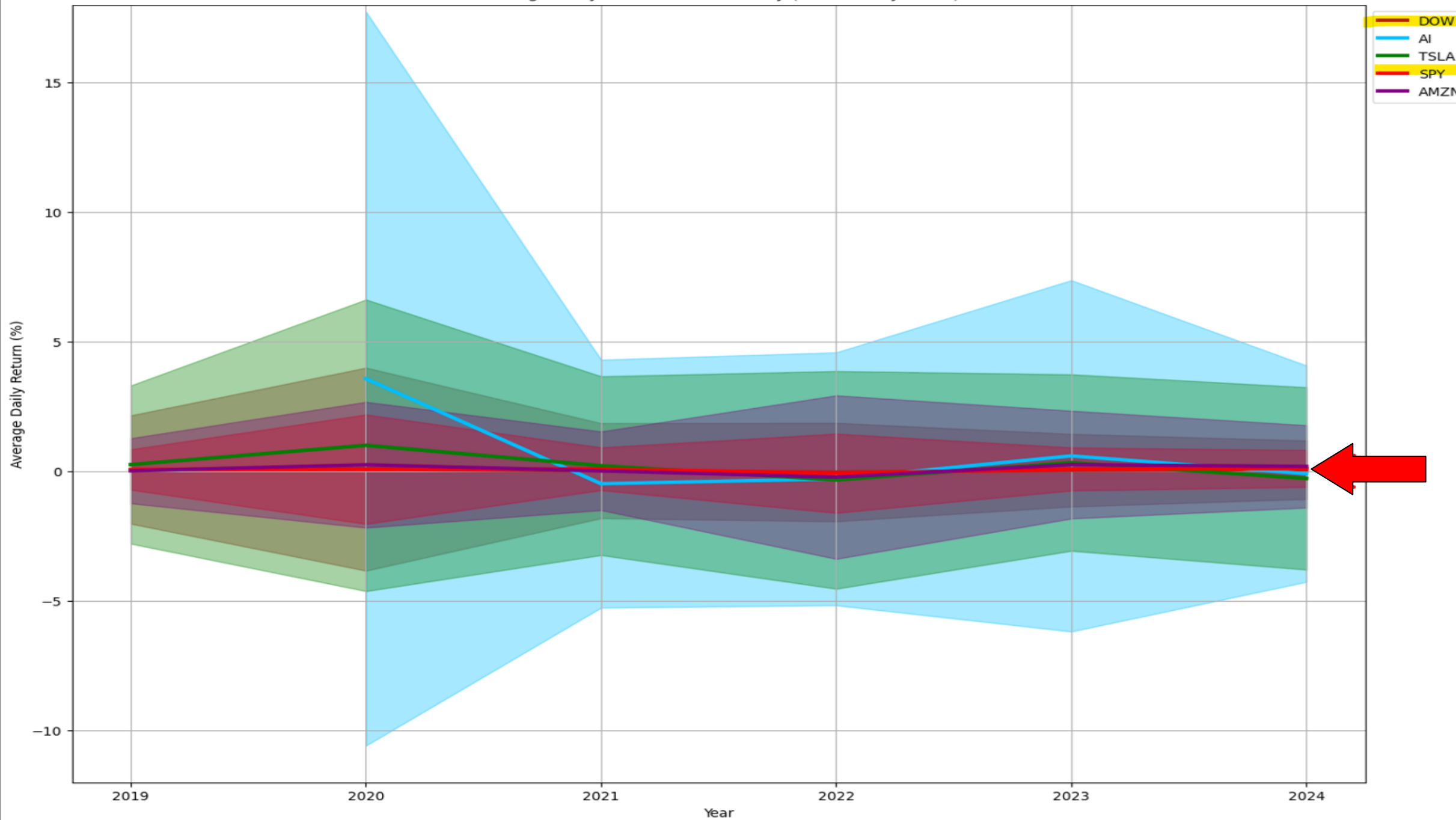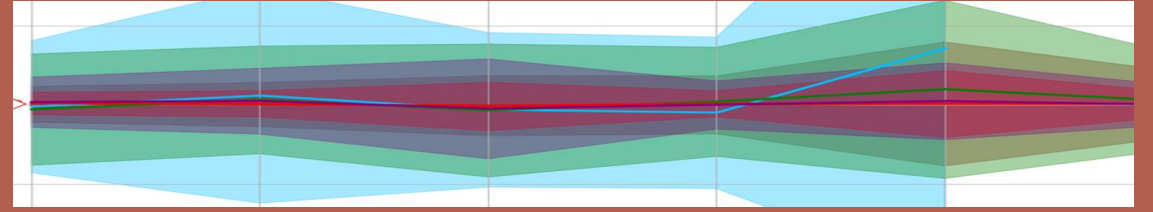Cumulative Return for each stock individually during 2019-2024

Average Daily Returns for Each Stock Year Over Year

Average Daily Return with Volatility (Selected Symbols)

Graph analysis

- This finding suggests no statistically significant difference in overall risk between the AI companies and the S&P 500 and Dow Jones indices.

- Our analysis revealed that AI and Tesla exhibited the highest volatility among the examined stocks. However, the remaining AI companies displayed relatively low risk with standard deviation measures falling below 10%.

- Our dataset does not provide insights into the reasons behind the increased volatility observed in Tesla and AI stock prices. For a deeper analysis, we recommend examining the publicly available financial records during the relevant period. This should include changes in key financial metrics such as sales numbers or revenue. Additionally, a sentiment analysis of media coverage, focusing on the frequency and tone of negative articles, may offer further insights.
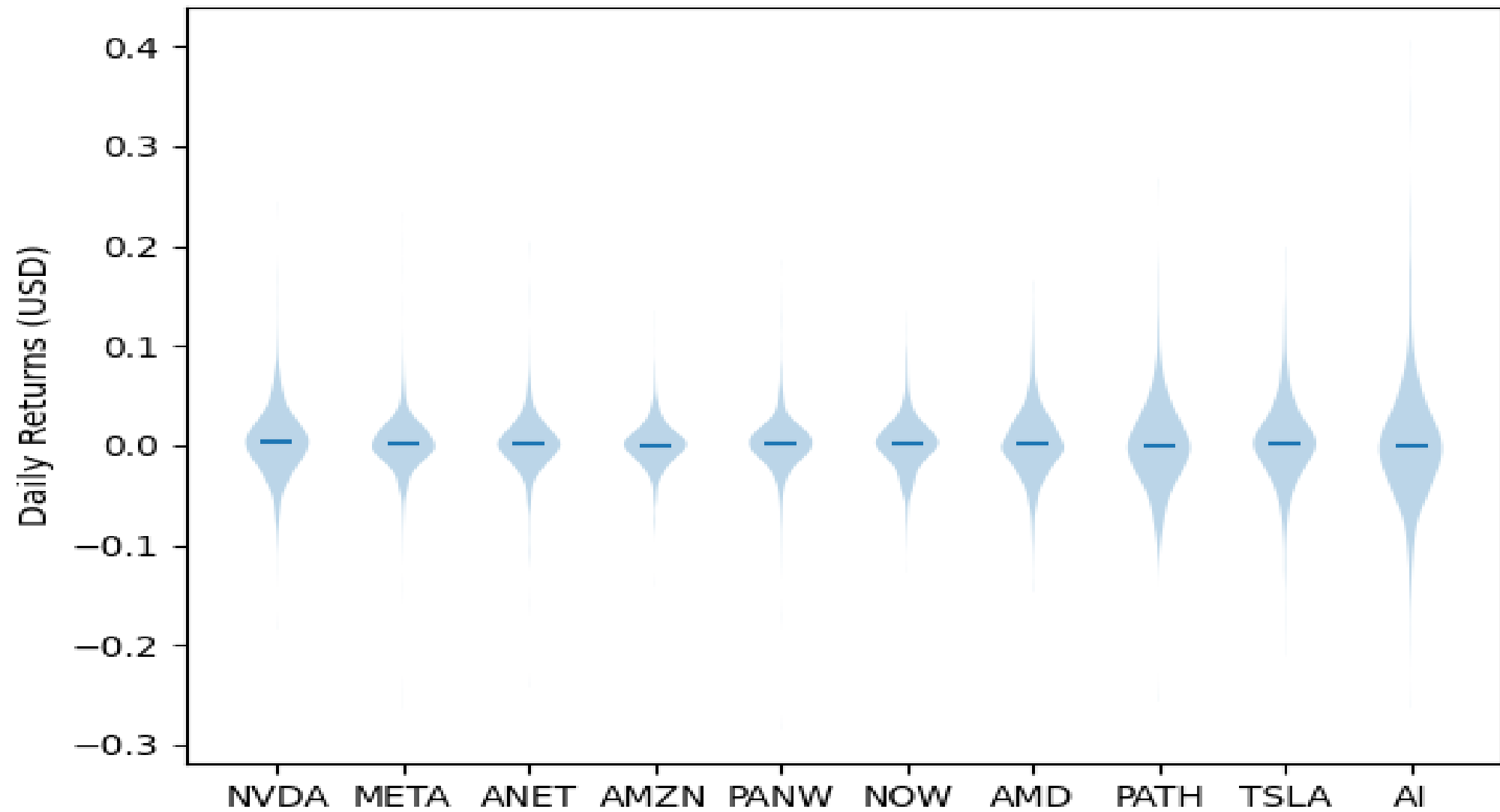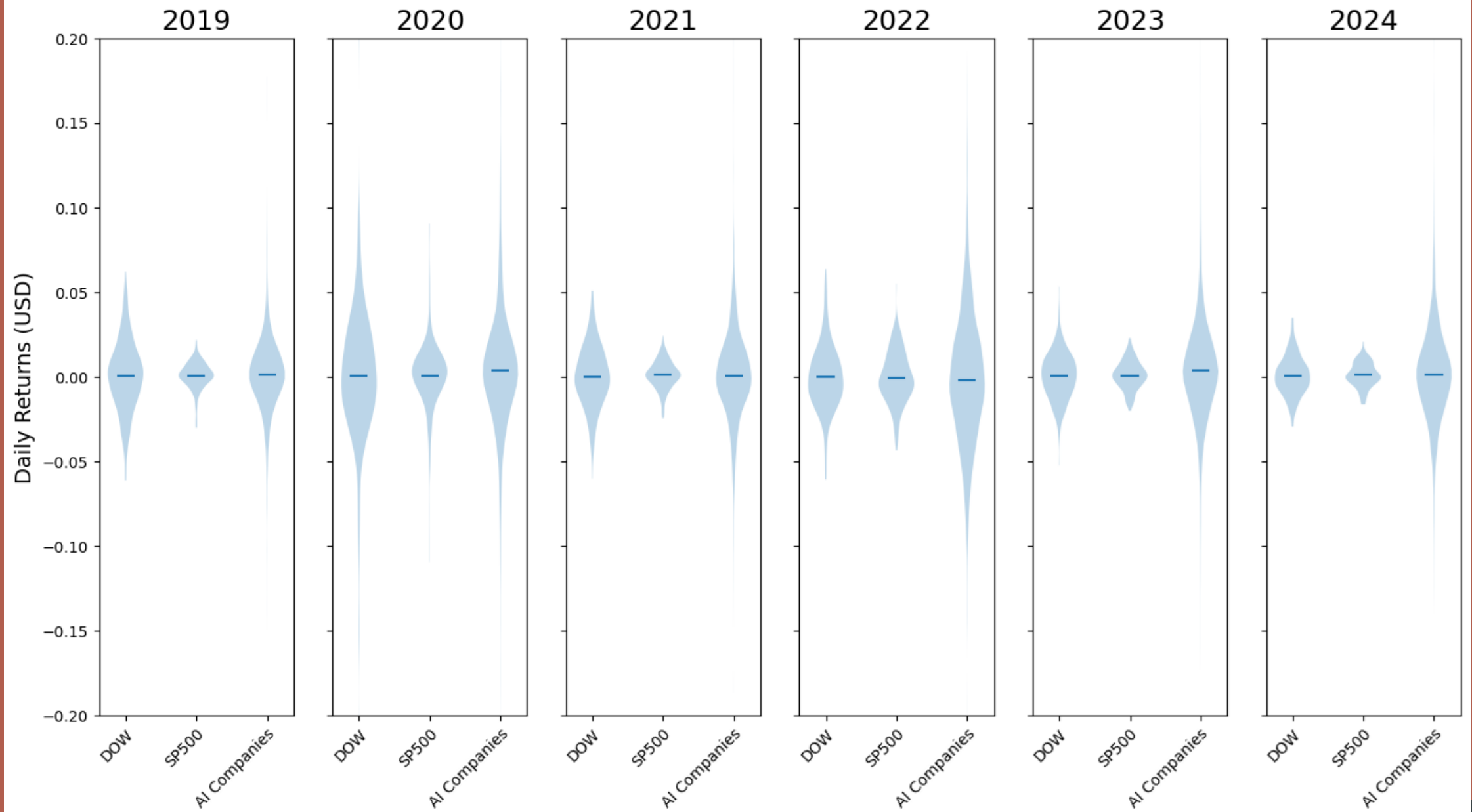
Average Closing Prices of Each Stock by Year
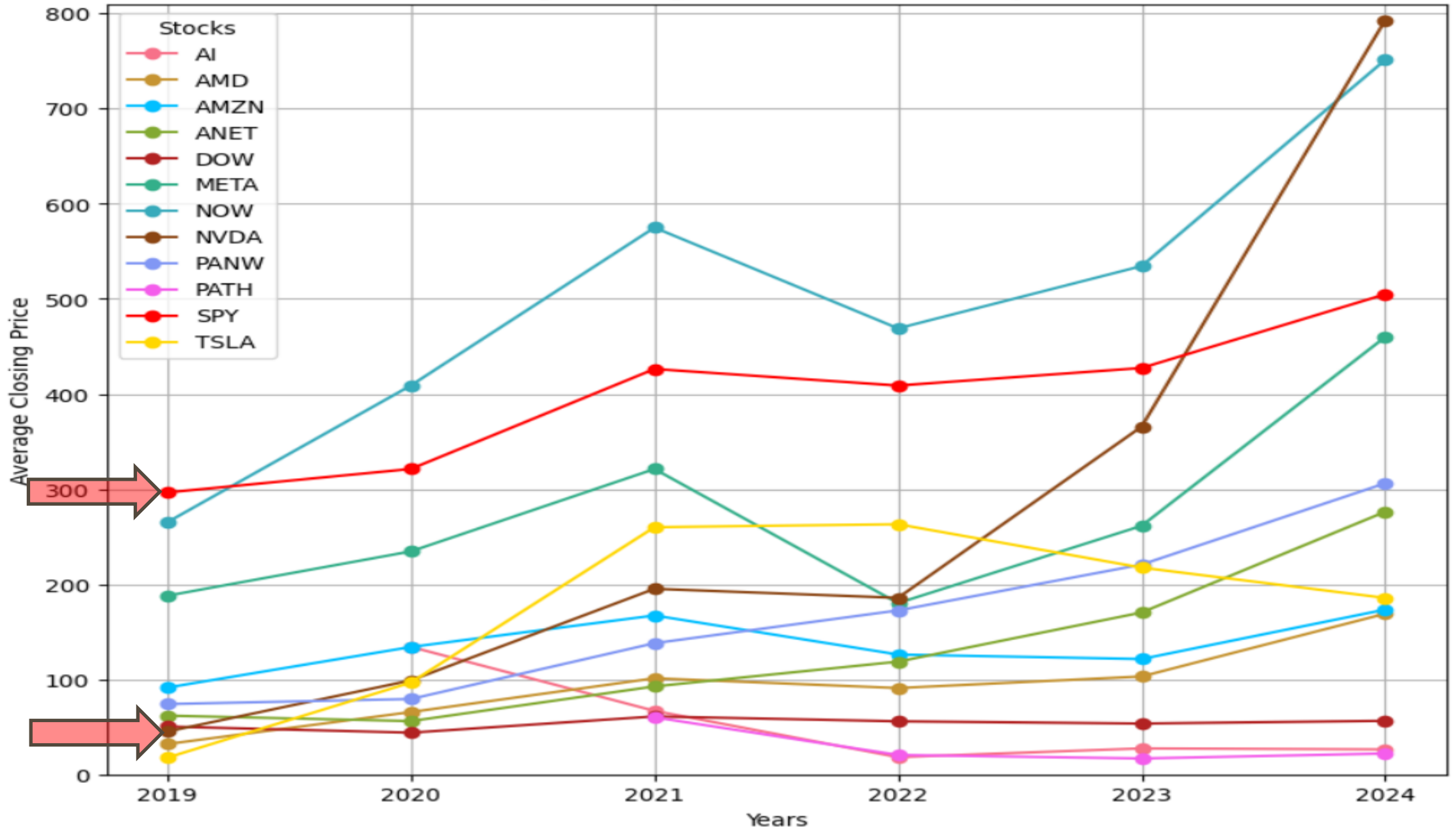
Average Closing Prices Over Time for each stock and indexes (Last 5 Years)
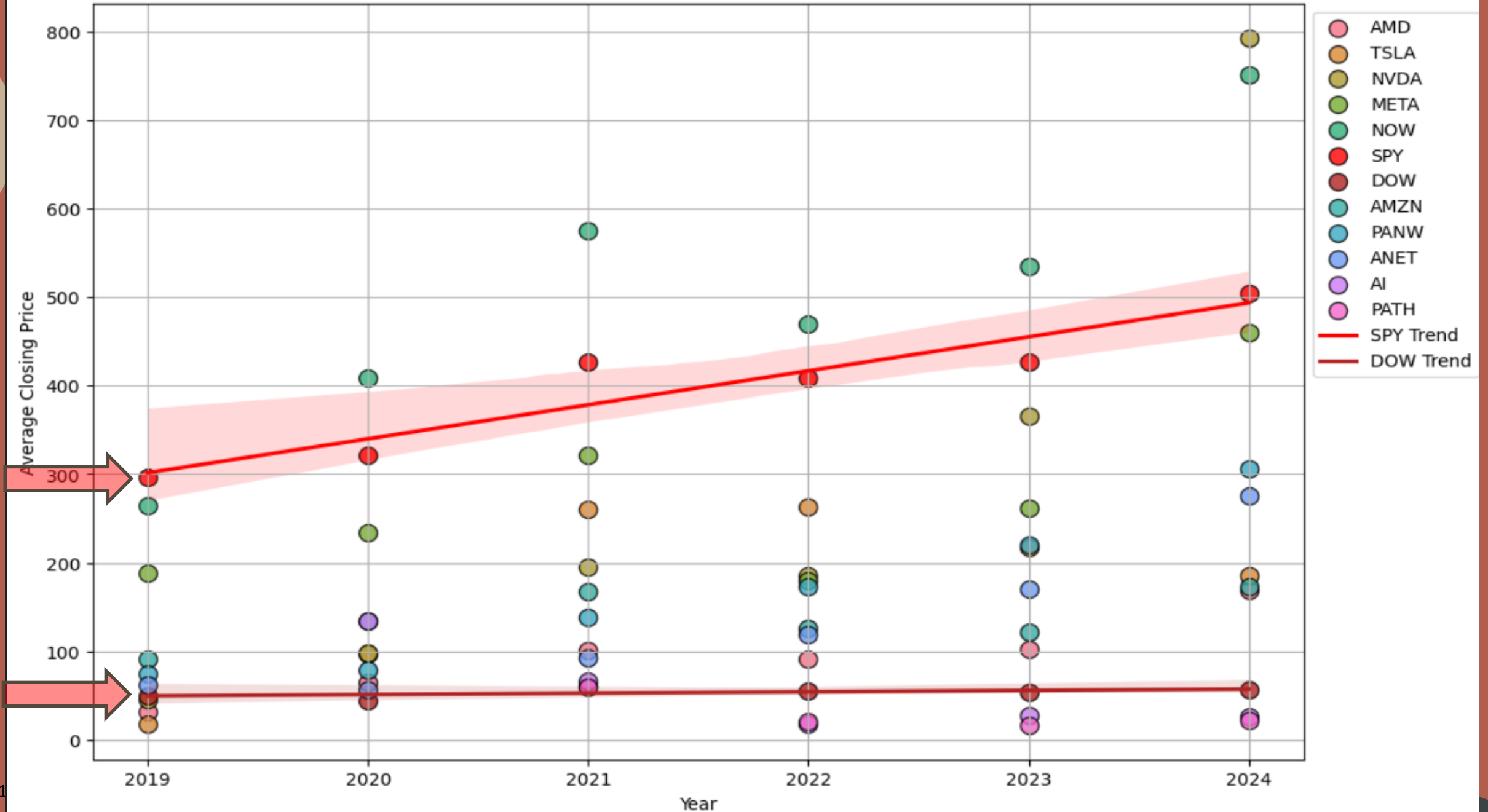
Daily Returns, all years

Daily Returns

Statistical Test #1: Repeated Measures Anova

Repeated measures ANOVA is used to test the difference between means over time for multiple groups. We want to know whether there is a statistical difference in the average daily mean return between the top 10 AI companies and the indices from 2019 to 2024.

General Hypothesis H0: all means are equal ; Ha: at least one mean is different

Hypotheses:	F-Statistic	Numerator DF	Denominator DF	P-Value
1. AI companies and indices	2.6513	5	15	0.0655
2. AI companies only	8.6322	5	35	0.0000

- 1: Fail to reject the null hypothesis. There is not enough evidence to suggest a difference between AI aggregate performance and indices ETFs.

- 2: Reject the null hypothesis. There is a significant difference in average daily returns per year across the top AI companies.

Statistical Test #2: Post-hoc Pairwise T-Tests

Pairwise Post-hoc Tests	T-Test statistic	P-Value
AMZN & NVDA	-2.8266	0.0368
META & NVDA	-2.9126	0.0332

Post-hoc pairwise t-tests are performed after a significant ANOVA test to see which mean pairs are driving the differences found among the groups.
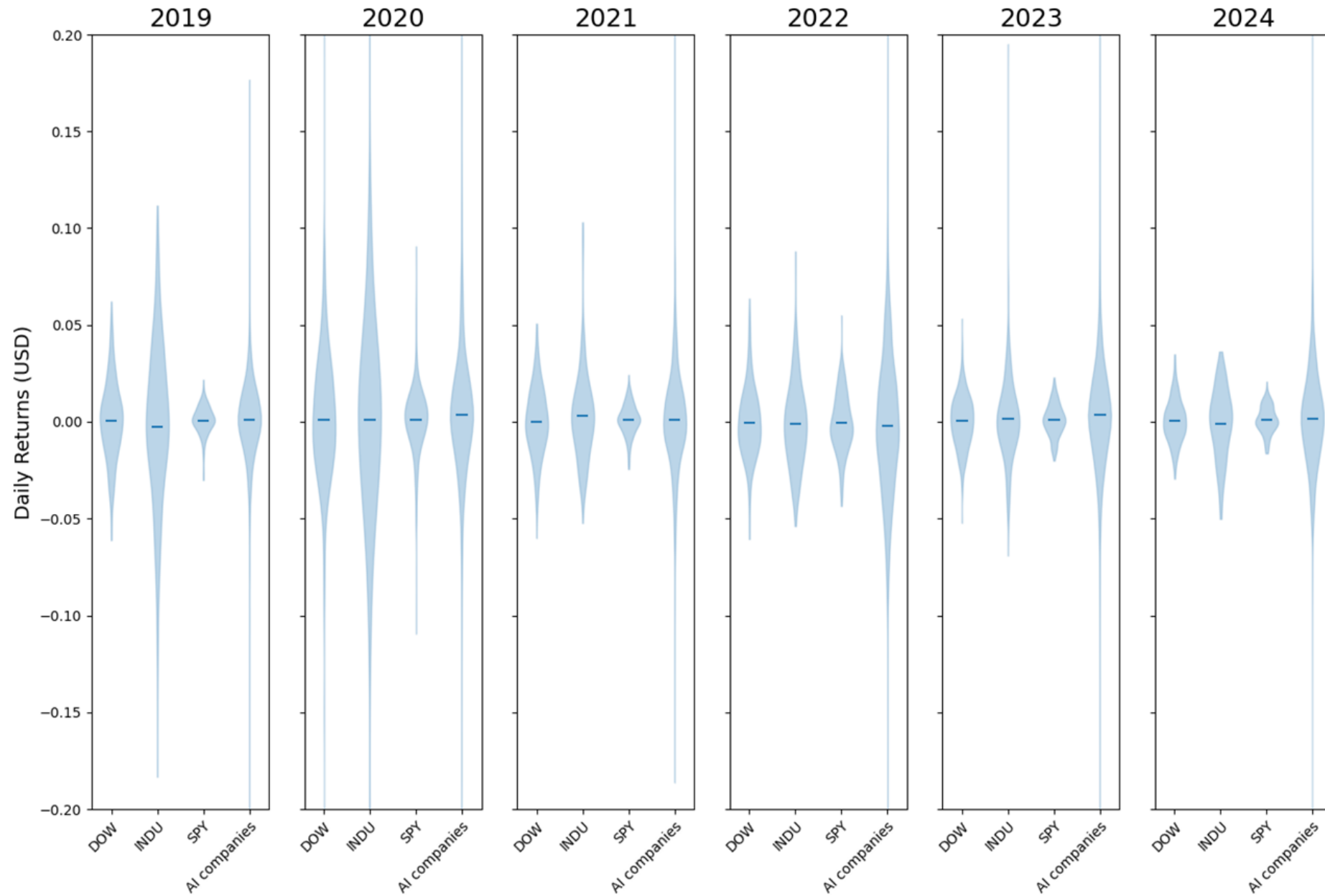
A **Bonferroni** adjustment is used to test for multiple comparisons, a necessary p-value adjustment when performing multiple tests.

- The t-test pairs showing a significant mean between 2019-2024 are between NVDA and AMZN and then NVDA and META.

Daily Returns, all years
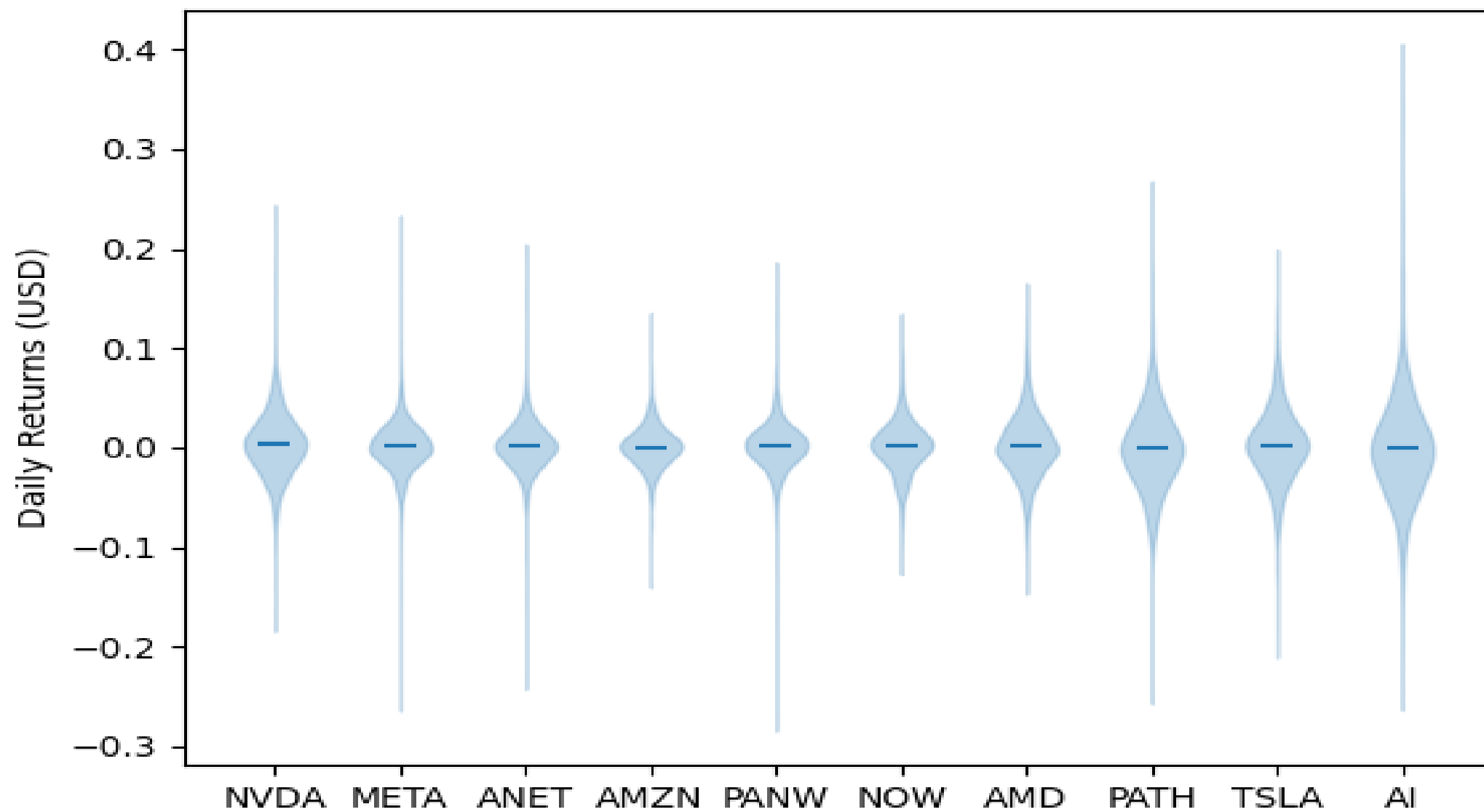
Daily Returns Outlined tailed

Correlation heatmap

- Indicates which stocks might be used as indicators for others

- May indicate if stocks in the same industry have a major impact on others

- Or if they are all equally subject to the same market pressures

- Meta returns are largely independent of other stocks (except Amazon)

- Nvidia, AMD, are greatly correlated, as expertly being largely GPU makers
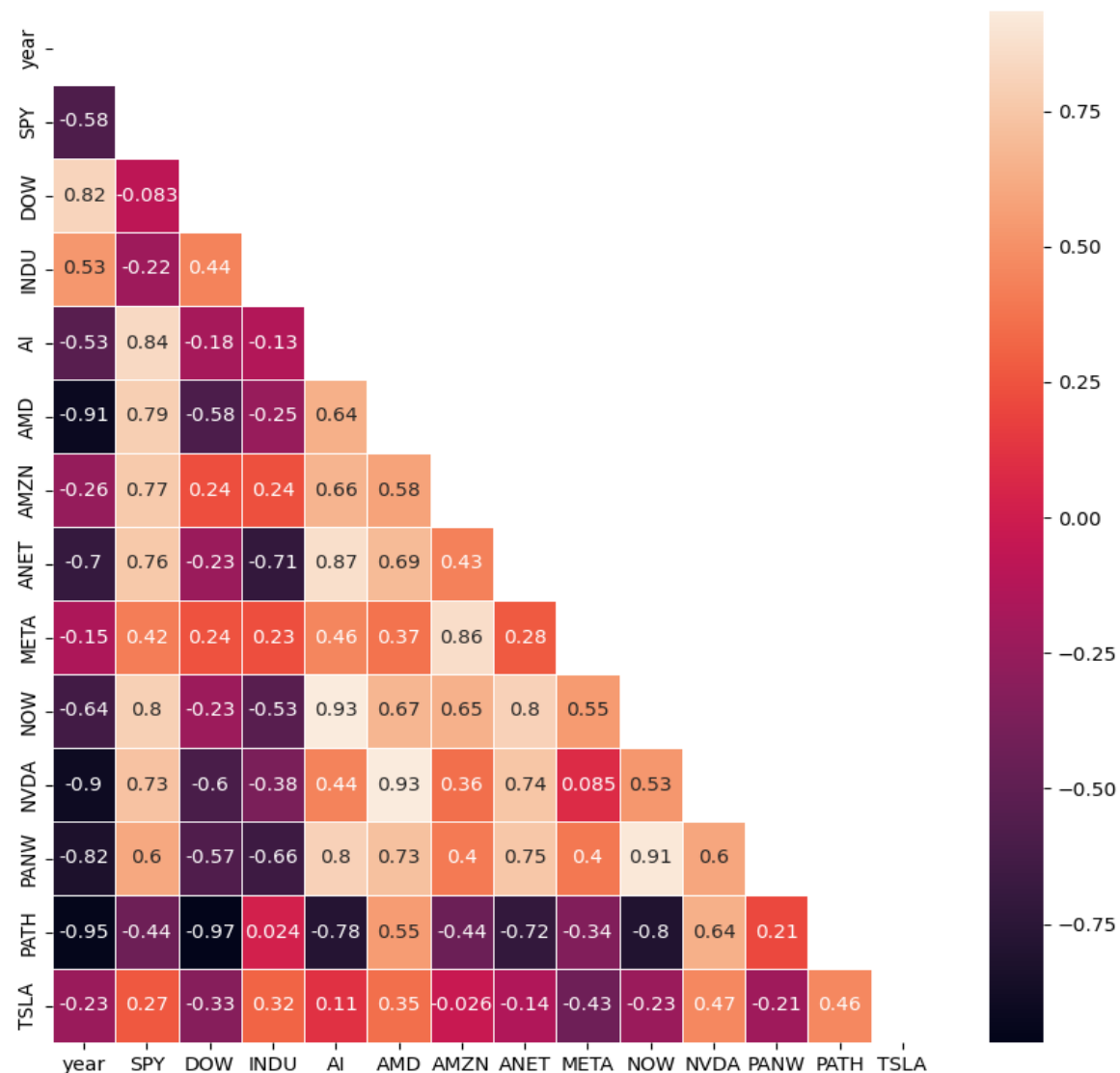
Conclusion

- Our analysis shows that while AI companies have strong returns and generally low volatility; they do not outperform or display lower risk than the S&P 500 and Dow Jones indices consistently.

- Since any difference is largely statistically insignificant, we fail to reject our null hypothesis, indicating AI companies in general are not different from the indices. Specific companies like Nvidia may not adhere to this generalization.

Data Limitations

- The S&P 500 includes 8 of the 10 AI companies we are comparing.

- Notably, some of the top 10 companies are not exclusively focused on AI products.

- The dataset available for free is quite limited.

- Our sample of 10 AI companies does not necessarily represent general AI market trends, but rather the stock performance of specific companies. Additionally, we aligned the timepoints between the Polygon API and the Kaggle dataset for consistent analysis.

Q&A

Thank you, all for listening and a special thank you to our team, for the great collaboration!

- Andrea M.

- Dante P.

- Krissy Nalani K.

- Melissa G.

- Nate S.

- Olga Sabrina L

The end.

Thank you for your interest!