

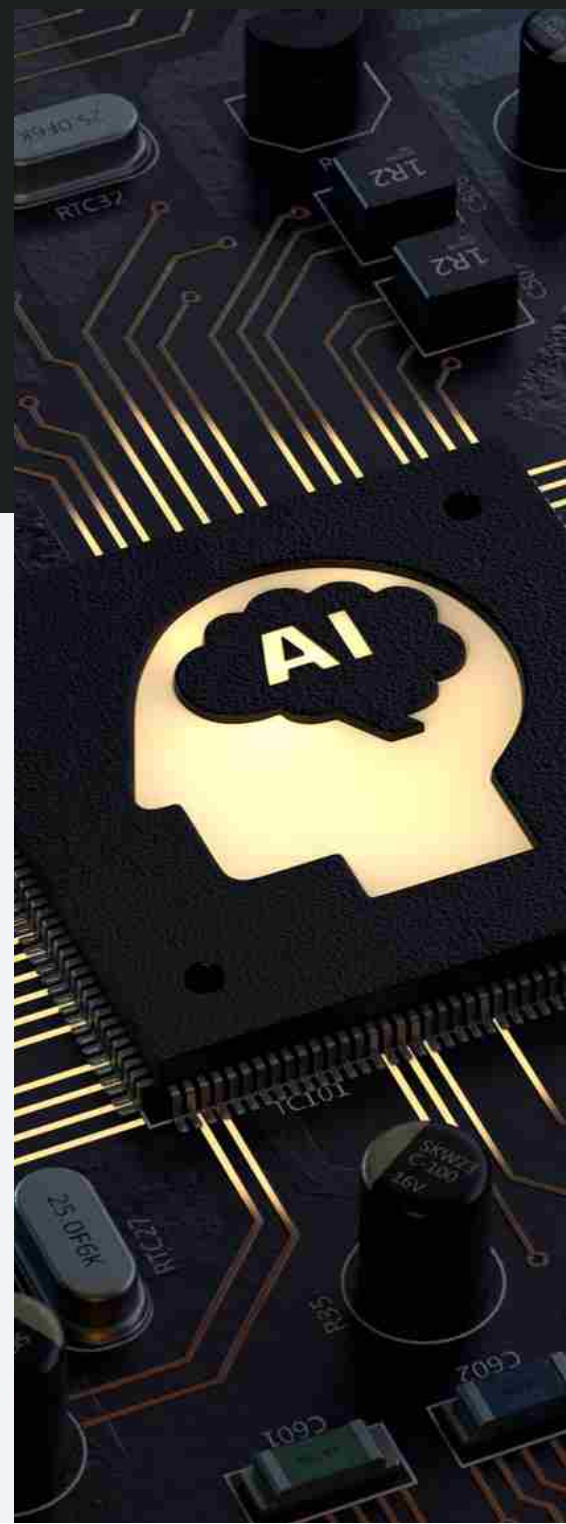
# AI Investment Solutions

StockSnips Thought Leadership Research

→ July 2023

## Introduction

In the quest for strategic advantage in the investment world, the imperative to leverage cutting-edge technologies has never been more profound. In this era of Big Data, Artificial Intelligence (AI), a term once confined to the realms of science fiction, has now matured into a powerful tool that is shaping numerous industries, with investing and asset management being positioned at the forefront of this technological revolution. This whitepaper seeks to shed light on the significant progress AI has made in the last 5 decades, its increasing prominence in the investment realm, and how our unique AI-driven solutions at StockSnips are transforming portfolio construction to improve client outcomes.



# Outline

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## The Three Waves of Artificial Intelligence

Over the past four decades, AI has undergone several significant transformations, each wave ushering in a new era of possibilities and challenges. These waves, ranging from rule-based expert systems to machine learning and the more recent contextual AI, are revolutionizing investment paradigms, enabling an unprecedented level of sophistication and efficiency.

The **first wave** of AI, which emerged in the 1970s, was characterized by domain-specific expert systems with reasoning capabilities based on rules. These systems were designed to create rule-based frameworks that could reason logically and solve problems by following a set of predetermined rules, relied heavily on symbolic representation of knowledge and logical inference, with experts in the domain manually creating these rules to encode their knowledge. While these systems were useful in solving specific problems in their respective domains,

they were limited by their inability to learn from data and adapt to new situations, leading to a stagnation in AI research in the 1980s. Despite these limitations, the first wave of AI laid the foundation for later waves, and its emphasis on logic and rule-based reasoning is still relevant in certain applications today.

The **second wave** of AI, which began in the 1980s and gained momentum in the 2000s, focused on statistical learning techniques such as large neural networks. This approach involved using large amounts of data and sophisticated algorithms to identify patterns and relationships within the data, enabling the system to make predictions or classifications. This wave of AI was successful in applications such as image and speech recognition, natural language processing, and recommendation systems, and paved the way for later waves of AI.

**1** Handcrafted Knowledge



**2** Statistical Learning



**3** Contextual Adaptation

The **third wave** of AI, known as contextual unsupervised learning, represents a significant shift in the way AI systems are designed and implemented. Rather than relying on rule-based or statistical learning approaches, this wave emphasizes the importance of contextual information and the ability of AI systems to interact with their environment and adapt to new situations. At the forefront of this wave are transformer architectures and large language models, which have enabled AI applications to achieve unprecedented levels of accuracy and sophistication in cognitive tasks. For example, through natural language processing and user intent recognition, contextual AI can create intelligent systems that understand and respond to human language and interactions in a more intuitive and natural way. The importance of contextual information is highlighted in the work of Vaswani et al., in their groundbreaking paper "Attention Is All You Need", which introduced a new transformer architecture for machine translation tasks. This approach to AI has the potential to revolutionize a wide range of industries, from healthcare to finance, by enabling AI systems to learn and adapt to new situations in a more human-like way.

**"90% of the world's data has been created in the last two years"**

— September 2021

**IBM**  
Marketing Cloud

## AI in Investing

From retail banking to asset management, the financial landscape is evolving at an unprecedented pace, driven by the rapid advancement and adoption of Artificial Intelligence (AI). The financial industry has leveraged the power of AI to enhance efficiency, improve investment decisions, provide more personalized risk management, and provide systematic active management strategies. Many prestigious firms are **incorporating AI into their investment approaches**, creating a race to harness its potential.

Large investment banks like J.P. Morgan and Blackrock have been actively integrating AI into their operations, utilizing machine learning algorithms to predict market trends and identify investment opportunities. Hedge funds, such as Renaissance Technologies and Two Sigma, are heavily relying on AI for their quantitative trading strategies. Robo-advisors like Betterment and Wealthfront are using AI to provide personalized investment advice and automated portfolio management services. Fintech startups, and a rapidly growing number of them, are exploring AI-powered solutions for risk management, fraud detection, and customer service.

Despite the varied applications of AI across these firms, a common goal unites them all: the quest for strategic advantage in an increasingly competitive and complex investment world.

## StockSnips AI Developments

Recognizing the potential early on, StockSnips has been at the forefront of leveraging AI advancements & **Large Language Models** (LLM) since inception in 2016.

While there are many sentiment vendors that use NLP, StockSnips has gone a step further by transforming discrete news on firms to a continuous signal that leverages financially trained LLMs. Our proprietary process of attributing the news to specific firms has given our AI model a remarkable ability to understand and analyze financial text, resulting in proprietary investor sentiment proxy that is a unique and has been validated to have predictive value.

2017

**Built a proprietary platform for NER, Sentiment Classification & a Sentiment Trend Indicator.**

2017

**Developed a financially trained classification model to deal with the complexity of Financial text and terms.**

2019

**Used a financially trained BERT model & proprietary Financial sentiment classification model**

2020

**Introduced AI Sentiment-based portfolios which have performed well in the live market environment.**

AI's journey is not just about technological evolution; it's about how it's applied.

The unique approach goes further, and incorporates the investor sentiment as a factor along with the Fama French factors, a cornerstone in modern portfolio theory that assumes rational investor behavior.

At StockSnips, we recognize investor emotions as a critical factor influencing market dynamics, and we have developed a unique AI-based News Sentiment estimation system, **MSDX**, that provides a nuanced, accurate measure of investor sentiment, a task only achievable through the power of AI.

Our innovation extends to portfolio construction, where we harness **investor sentiment to achieve alpha**, a performance edge that has become increasingly elusive in the face of rising competition and market complexity. We've designed and built StockSnips' AI-driven portfolios to outperform benchmark indexes, navigating the turbulence of today's data-rich landscape to separate the signal from the noise. Our AI capabilities allow us to measure and predict micro-sentiment at the individual firm level, creating a more precise tool for portfolio managers.

## What is StockSnips Unique Investor Sentiment Signal (MSDX)?

StockSnips has developed an AI-based News Sentiment estimation system which uses news articles from established sources and asserts the sentiment of each financially "oriented" sentence within an article.

Using **AI-driven attribution & Large Language Models** trained with financial news – the StockSnips AI engine is unique in terms of both its approach and rigor. The aggregate value of news-based sentiment assessed at the discrete sentence level using the financially trained AI model, from reputed news sources, can a-priori be expected to be less "noisy" and possibly less "biased" versus social and other types of sentiment signals. StockSnips transforms the discrete nature of news for a firm to a continuous signal using a memory sentiment decay model that takes the volume and frequency of news while attenuating the signal.

StockSnips daily ticker-level sentiment is calculated through a sophisticated AI platform that extracts, classifies, and scores relevant news snippets. This ability to **derive sentiment from a broad range** of financial information sources underscores the robustness and versatility of our approach. Moreover, our proprietary ranking algorithms leverage sentiment and sentiment momentum to offer tailored solutions for various equity universes.

The extensive history and corpus of financial articles has enabled over the years, our AI model to continuously learn and improving, developing a deep and nuanced understanding of financial markets that is hard to match. This vast corpus of data, a challenge for any new market entrants, allows our AI to identify patterns and trends that are invisible to the human eye.

**"The importance of implementing new technologies simply cannot be overstated".**

Jamie Dimon | JP Morgan



## How does StockSnips Compare to Other AI Offerings?

- **Diverse Data Sources:** By pulling in data from over 25 content sources, StockSnips' AI has a more comprehensive and multi-dimensional view of the market. It captures a wider range of opinions, insights, and perspectives, which can lead to more robust and well-rounded analysis. This diversity can help uncover insights that may be missed when only a single source is used.
- **Crowd Wisdom:** The variety of sources also allows StockSnips' AI to tap into the "wisdom of the crowd" - a phenomenon where aggregated information from a diverse group often leads to better decisions than could be made by any single individual or organization. This can be especially valuable in financial markets, where sentiment and opinions significantly impact asset prices.
- **Resilience to Bias:** Using multiple sources also reduces the risk of bias that can come from relying on a single source. If any particular source has a consistent slant or bias in its reporting, this can be balanced out by the other sources.
- **Real-Time Analysis:** By analyzing articles on a continuous real-time basis, StockSnips' AI can provide up-to-the-minute insights, crucial in the fluidity of the stock market.
- **Advanced Predictive Capability:** Drawing from its extensive training and deep understanding of financial text, StockSnips AI offers predictive insights, providing a strategic advantage in forecasting market trends and movements.

## Incorporating Investor Sentiment into Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model (CAPM) is a widely used asset pricing model traditionally based on the assumption of rational behavior among investors, with asset returns determined by the risk-free rate, the expected market return, and the asset's beta (a measure of its sensitivity to market movements). **The model does not inherently account for investor sentiment** or for herding behavior and other forms of sentiment in financial markets, leading some researchers to argue that the model may be incomplete or inaccurate as a result.

Investor sentiment can be thought of as the aggregate mood or **attitude of investors** towards the market or a particular security. It can be influenced by various factors such as news events, market performance, economic indicators, and social media trends. When investor sentiment is overwhelmingly positive, it can drive prices above their fundamental values, and conversely, when sentiment is negative, prices can be driven below their fundamental values.

There is a growing body of research that seeks to incorporate herding behavior and other forms of sentiment into asset pricing models. For example, some researchers have proposed models that incorporate measures of investor sentiment or market volatility into the CAPM or other asset pricing frameworks, while others have developed more complex models that explicitly model herding behavior. In this new frictionless information world of social media, the impact of consumer and market sentiment, is posited to be a significant factor that can impact stock price modeling.



### Ravi Koka - StockSnips Founder & CEO

"Recognizing the impact of investor sentiment is crucial in today's dynamic markets. While the traditional CAPM provides a valuable framework, integrating sentiment indicators allows us to better understand and capture the behavioral aspects of investing. By acknowledging the role of emotions and beliefs, we can enhance our asset pricing models and make more informed investment decisions."

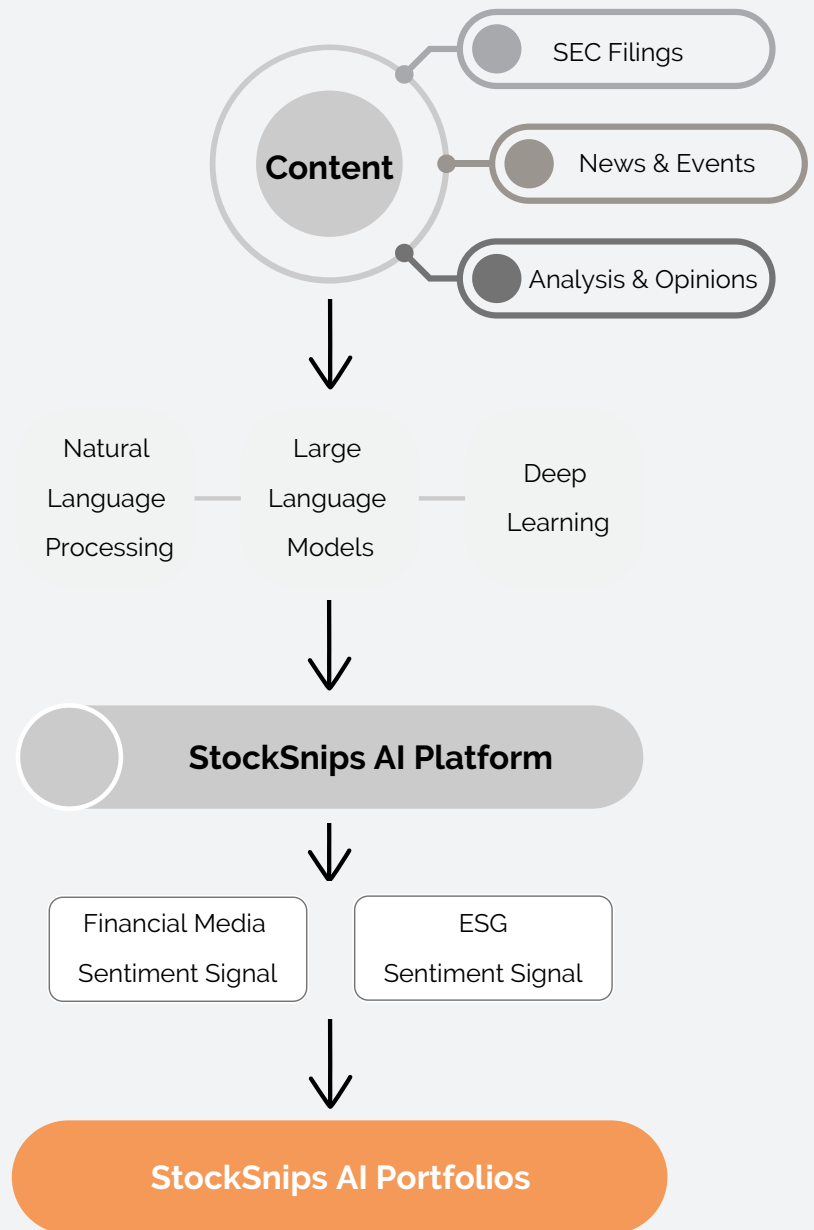
# Portfolio Construction that Leverages Investor Sentiment to Achieve Alpha

In the last decade active investing has been under pressure, and a majority of the active mutual funds have underperformed the passive indexed funds. In the last few years **more than 50% of assets have moved into indexed funds** from firms like Vanguard, Blackrock and State Street. Jack Bogle's bet on investing in a broad set of equities comprising the S&P 500 and lowering the expense ratio proved to be a huge success. Factor-based portfolios that use historical fundamentals data like revenue, earnings and PE and pick stocks have higher expense ratios, and only a small number have outperformed the index.

## StockSnips AI Platform

Designing and building Stock portfolios to outperform benchmark indexes is the ever-present challenge facing portfolio managers. It is perhaps more challenging in the current era where **market emotions and their underlying sentiments** are generating increased turbulence in the analytical landscape. Markets are constantly impacted by frequent injections of social media, and new sources of investor sentiment and chatter. Marshall McLuhan's prediction of the world becoming a Global Village, where "the medium is the message" has come true. Global markets are flooded by an enormous deluge of data & noise. Separating the signal from the noise out this turbulence is a major challenge for Asset Managers.

StockSnips AI Platform is a sophisticated tool that uses artificial intelligence and machine learning algorithms to **analyze & derive investor sentiment from news articles** in order to make investment decisions without human intervention. This approach involves analyzing news articles to identify the sentiment expressed within them, such as whether they are positive or negative about a particular company or market trend.



We know that sentiment is an important and often leading factor in price movements. There are several indicators of sentiment like fund flows, Put/Call ratios, VIX and other investor surveys. However, they reflect severe limitations in the state-of-the-art of measuring sentiment. Most sentiment analysis using the survey methodology remains at a macro-level. Expectation data are focused on economic factors such as inflation, employment, and related measures of about future economic performance. For portfolio managers, in order for sentiment to be a factor in stock selection for portfolio construction, it needs to be much more precisely measured and predictive. What is needed is Micro-sentiment focused at the individual firm level. Actually, measuring sentiment about a particular company is not easy to do. Sifting through thousands of documents and internet mentions of stocks is beyond a person's ability. Such a task is an ideal application of Artificial Intelligence.

## Let's Define Sentiment and Where it Comes From.

The daily ticker level sentiment is calculated as the percentage of positive news snippets extracted from a large number of financial media news articles, using the StockSnips AI platform. A snippet is defined as relevant text in an article that can be attributed to a specific stock ticker, which is then scored using a machine learning model trained for classification of financial news positivity or negativity. StockSnips uses a **proprietary financially trained machine learning** to classify snippets of text according to whether it was positive or negative. This procedure is run independently of returns data. Moreover, it does not itself resolve the ambiguity between psychological- and fundamentals-driven positivity or negativity in snippets.

There are several different news sources for these snippets covering a wide range of financial information providers (including, but not limited to: SEC Filings forms 10-K and 10-Q, Motley Fool, Reuters, and Zacks). StockSnips Daily Sentiment is derived by **transforming discrete news to a continuous signal** using a memory-based attenuation model that considers news volume, recency, and source, with the final sentiment score expressed as a percentage. Studies have also shown that the rate of change of sentiment is important in addition to sentiment and large and small/midcap equities react differently to these measures.

## Ranking Algorithms that Utilize Sentiment & Sentiment Momentum

In the pulsating heart of the financial markets, sentiment ebbs and flows, influencing stock prices with an intensity that can sometimes **outpace traditional market indicators**. At StockSnips, we've harnessed the power of sentiment analysis and developed a pioneering approach to portfolio construction that relies on a proprietary ranking algorithm. This bi-factor model leverages both sentiment and sentiment momentum, creating a unique blend of market insights.

Our **AI Engine**, tirelessly analyzing a vast corpus of financial news, distills market sentiment into a comprehensible metric that offers a window into the market's perception of a company. Sentiment momentum, on the other hand, tracks the rate of change in this sentiment. The combination of these two factors often serves as a leading indicator of future price movements, providing investors with a crucial edge.

This algorithm is not confined to a single universe but extends across various equity environments, including the S&P 500, Russell 1000, and Nasdaq Composite companies. The selection process is meticulous and carefully calibrated, taking into account an array of factors such as fundamentals, industry cycles, stock volatility, and other parameters that influence the portfolio's risk profile. This allows us to construct portfolios that are **designed to seize potential upside from sentiment shifts** while effectively managing downside risk.



# Optimizing Returns for Diverse Risk Profiles

At StockSnips, we embrace the fact that investors are as diverse as the markets they navigate. Each investor has a unique risk tolerance and investment horizon, and our range of portfolios is reflection of this diversity. Designed to optimize returns for various risk profiles, these portfolios are the culmination of our pioneering approach to sentiment-based investing.

These portfolios are not just theoretical constructs. They have been rigorously back-tested, their performance simulated based on historical data to ensure they can meet the anticipated risk and return objectives. Furthermore, they have been trading live for close to two years, offering invaluable real-world insights into their performance.

By integrating our advanced sentiment analysis and sophisticated ranking algorithm, these portfolios aim to deliver superior risk-adjusted returns. This offers investors a unique opportunity to benefit from the cutting-edge advances in AI and sentiment analysis, presenting a novel way to steer through the intricate maze of the financial markets.

## Meet Our Portfolios



All Cap  
Weekly



Multi-factor All Cap  
Monthly



Low-beta Large Cap  
Weekly



US Sector Sentiment  
Weekly

### HYPOTHETICAL RETURNS

3 YEAR ANNUALIZED RETURNS SHOWN, AS OF MARCH 31 2023

**ALL CAP**  
**29.47%**

**STRATEGY:** PROVIDING LONG TERM GROWTH  
**REBALANCING:** WEEKLY  
**BACKTEST:** JULY 10, 2017 - MAY 7, 2021  
**LIVE TRADING:** MAY 10, 2021 - PRESENT

	3 Month	YTD	1 Year	3 Year Annualized	Since Inception
StockSnips Weekly All Cap	1.24%	1.24%	0.25%	29.74%	18.48%
SPDR S&P 500 ETF Trust	7.46%	7.46%	-7.81%	18.50%	

**LARGE CAP**  
**19.18%**

**STRATEGY:** PROVIDING GROWTH WITH LOWER VOLATILITY  
**REBALANCING:** WEEKLY  
**BACKTEST:** JULY 10, 2017 - JULY 2, 2021  
**LIVE TRADING:** JULY 8, 2021 - PRESENT

	3 Month	YTD	1 Year	3 Year Annualized	Since Inception
StockSnips Weekly Low Beta Large Cap	3.17%	3.17%	-2.19%	19.18%	17.37%
SPDR S&P 500 ETF Trust	7.46%	7.46%	-7.81%	18.50%	

**MULTI-FACTOR ALL CAP**  
**23.55%**

**STRATEGY:** PROVIDING LONG-TERM CAPITAL APPRECIATION WHILE LIMITING VOLATILITY  
**REBALANCING:** MONTHLY  
**BACKTEST:** JULY 10, 2017 - NOV 29, 2021  
**LIVE TRADING:** NOV 30, 2021 - PRESENT

	3 Month	YTD	1 Year	3 Year Annualized	Since Inception
StockSnips Monthly Multi-Factor All Cap	7.75%	7.75%	2.25%	23.55%	21.19%
SPDR S&P 500 ETF Trust	7.46%	7.46%	-7.81%	18.50%	

**US SPDR SECTOR ETF**  
**21.62%**

**STRATEGY:** PROVIDING LONG-TERM CAPITAL APPRECIATION WHILE LIMITING VOLATILITY  
**REBALANCING:** MONTHLY  
**BACKTEST:** JULY 10, 2017 - DEC 9, 2022  
**LIVE TRADING:** DEC 12, 2022 - PRESENT

	3 Month	YTD	1 Year	3 Year Annualized	Since Inception
StockSnips Weekly US Sector Sentiment	0.29%	0.29%	-13.93%	21.62%	15.90%
SPDR S&P 500 ETF Trust	7.46%	7.46%	-7.81%	18.50%	

# Dealing with Shifting Market Regimes

Non-linearity and Non-Stationarity of stock market time series data

Stock market data presents a multitude of challenges that must be addressed to develop robust models. Most models are marred by the problems of over fitting, heuristics and poor out of sample results. This is because, **the financial domain is hugely complex and non-linear** with a plethora of factors influencing each other. First, the relationship between stock prices and their underlying factors is often non-linear, which means that traditional linear models may not be effective in predicting price movements.

Second, non-stationarity is another technical challenge that can make it difficult to model stock prices accurately. Non-stationarity refers to the idea that the statistical properties of **stock price data can change over time**, which means that historical patterns may not be a reliable guide to future price movements. Non-stationarity can arise for a variety of reasons, including changes in market conditions, shifts in investor sentiment, or changes in the regulatory or economic environment. When data is non-stationary, traditional statistical and machine learning models that assume stationarity may not be effective in capturing the underlying dynamics of the data. To address non-stationarity, advanced machine learning techniques such as deep learning and recurrent neural networks can be used, as these models are better able to capture non-linear relationships and temporal dependencies in the data.

StockSnips is currently researching advanced deep learning and unsupervised learning models that could potentially adapt dynamically as market regimes change. The success in some of these models in robotics and autonomous driving is promising and we believe the stock market scenarios are somewhat similar. Models that can **poll the environment and continuously adjust** based on what they have learned from their training hold promise and early results are indicative of their fit for dealing with non-stationarity.

## The Use of Advanced Deep Learning & Unsupervised Learning Models to Dynamically Adapt as Market Conditions Change

To address the above challenges, StockSnips employs advanced deep learning and unsupervised learning models. **Deep learning models**, with their ability to model complex, hierarchical relationships in data, are particularly well-suited to handling the non-linearity in financial data.

**Unsupervised learning models**, on the other hand, are designed to discover hidden patterns in data without the need for explicit labels. This makes them ideal for handling the non-stationarity of financial data, as they can dynamically adapt to new patterns as they emerge.

By utilizing powerful AI techniques, StockSnips offers a flexible and adaptive approach to investing. This approach is specially designed to navigate the complex and ever-changing landscape of financial markets and allows investors to tap into the benefits of AI, providing a fresh and effective way to reach their investment goals, even in the face of challenging market conditions.



# The Future of AI in Investing

As we stand on the brink of a new era in asset management, the transformative power of Artificial Intelligence (AI) casts an exciting, formidable shadow over traditional practices. Poised to redefine every aspect of the industry, **AI's touch is sweeping**, reshaping everything from portfolio construction and risk management to trade execution, customer service, and even regulatory compliance.

One of the pioneering platforms **leading this evolution is StockSnips**, a powerful embodiment of AI's immense potential in asset management. This platform serves as a compelling illustration of how AI can streamline and elevate several key aspects of the field:



- **Enhanced Data Analysis:** StockSnips pioneered the use of unstructured data by using large language models to analyze voluminous financial news and deriving a continuous investor sentiment signal giving RIAs and Asset Managers the ability to review investment landscapes through a behavioral finance lens. By harnessing structured and unstructured data from sources like news, analyst opinions, and SEC Filings, StockSnips has generated a new factor that captures market emotions. This AI-driven analysis is helping RIAs and Asset Managers make systematic, sentiment-backed investment decisions. We see great potential in further expanding this analysis to other financial media like TV, podcasts, and content from various geographic regions like Europe, South East Asia and Latin America. LLMs make it easier to process news in languages other than English.
- **Improved Risk Management:** StockSnips sees great potential in applying AI in effective risk management. The ability to identify complex patterns and relationships in data will allow for dealing with systemic and idiosyncratic risks in a more timely and contextual manner. Delivering intelligence at the right time, place and to the appropriate users will make it more actionable to avoid large losses in assets.
- **Personalized Services:** AI has been in use by Robo-advisors to automate needs analysis and recommendation based on the user's risk profile. These platforms however typically only recommend ETFs, bonds and passive indexed funds. Personalized active investing is where we see AI making an impact. There are a large number of portfolio choices worldwide and a systematic data driven approach that optimizes risk adjusted returns would make it more attractive to investors who are looking for diversification and strategies that outperform benchmarks. Delivering active strategies to investors at a reasonable fee is achievable with AI models and for RIAs this would be a competitive edge given that a large amount of funds has moved into passive funds.
- **Cost Efficiency:** StockSnips AI Portfolios help to improve firms investment efficiency and remain low cost for high performing active strategies. By automating the analysis of large volumes of unstructured news and deriving a powerful sentiment signal, StockSnips allows RIAs and Asset Managers to focus more on strategic decision making and client servicing. The reduced costs and increased productivity offered by StockSnips make it an essential tool for RIAs seeking innovation to optimize their practice and maximize client satisfaction.

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JPMorgan Chase currently has over 1000 people involved in data management, more than 900 data scientists - AI and machine learning experts who create new models - and 600 ML engineers.

In addition, a 200-person AI research group is looking at the **"hardest problems and new frontiers in finance"**.

April 2023

For the contemporary RIA firm, the rise of AI embodies a duality: **a realm of opportunities juxtaposed with formidable challenges**. Many RIA firms, particularly those lacking the resources or expertise for in-house AI development, might consider outsourcing as an attractive alternative, while introducing AI as their newest **'co-pilot'**. Utilizing platforms such as StockSnips offers a gateway to cutting-edge AI technology and expertise, while eliminating the burden of hefty initial investment. This strategy allows firms to concentrate on their essential proficiencies, such as client relationships and crafting strategic growth plans.

For those firms contemplating competing with AI-driven asset managers, it's crucial to acknowledge that while AI confers considerable advantages, **it's not the be-all and end-all**. The human element, seamlessly integrated into platforms like StockSnips through personalized services, remains integral to asset management.

To conclude, the future of AI in asset management holds immense promise but also brings its unique challenges. Firms must adopt a proactive stance in discerning the potential repercussions of AI on their operations and harnessing this technology optimally. Solutions like StockSnips AI-driven Portfolios constitute an efficient conduit for firms to navigate towards the promising horizon of AI-augmented asset management.

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