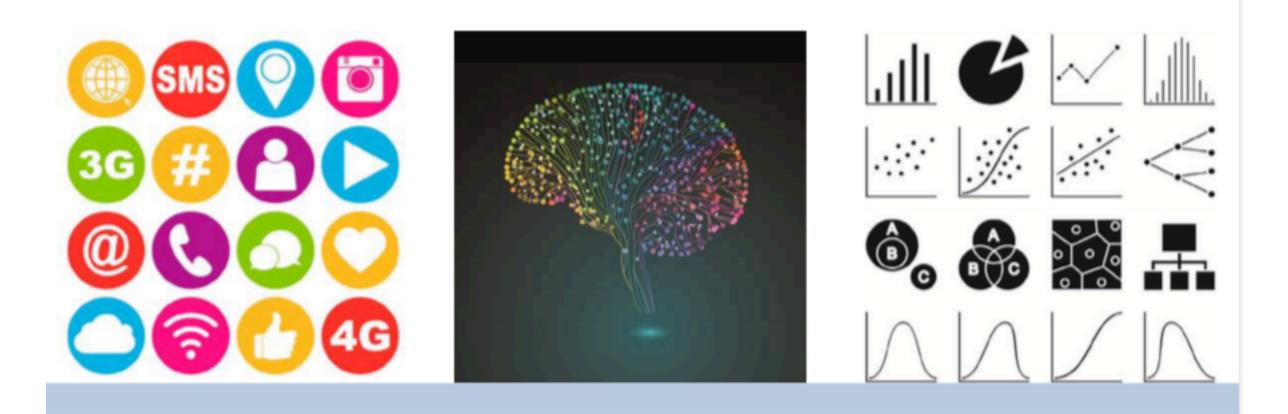
# J.P.Morgan



# Big Data and Al Strategies

Machine Learning and Alternative Data Approach to Investing

I: INTRODUCTION AND OVERVIEW

Junho Song

# I: INTRODUCTION AND OVERVIEW

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#### Dear Investor.

Over the past few years, we have witnessed profound changes in the marketplace with participants increasingly adopting quantitative investing techniques. These include Risk Premia investing, algorithmic trading, merging of fundamental and quantitative investment styles, consumption of increasing amounts and differentiated types of data, and adoption of new methods of analysis such as those based on Machine Learning and Artificial Intelligence.

In fact, over the past year, the exponential increase of the amount and types of data available to investors prompted some to completely change their business strategy and adopt a 'Big Data' investment framework. Other investors may be unsure on how to assess the relevance of Big Data and Machine Learning, how much to invest in it, and many are still paralyzed in the face of what is also called the 'Fourth Industrial Revolution'.

In this report we aim to provide a framework for Machine Learning and Big Data investing. This includes an overview of types of alternative data, and Machine Learning methods to analyze them. Datasets are at the core of any trading strategy. For this reason, we first classify and analyze the types of alternative datasets. We assess the relevance of various datasets for different types of investors and illustrate the use of Big Data in trading strategies. Datasets covered include data generated by Individuals (e.g. social media), data generated by business processes (e.g. commercial transactions) and data generated by machines (e.g. satellite image data). After focusing on Datasets, we explain and evaluate different Machine Learning methods which are necessary tools to analyze Big Data. These methods include Supervised Machine Learning: regressions, classifications; Unsupervised Machine Learning: clustering, factor analyses; as well as methods of Deep and Reinforcement Learning. We provide theoretical, practical (e.g. codes) and investment examples for different Machine Learning methods, and compare their relative performance. The last part of the report is a handbook of over 500 alternative data and technology providers, which can be used as a rough readmap to the Big Data and Artificial Intelligence landscape.

We hope this guide will be educative for investors new to the concept of Big Data and Machine Learning, and provide new insights and perspectives to those who already practice it.

Marko Kolanovic, PhD

Global Head of Macro Quantitative and Derivatives Strategy

J.P. Morgan Securities LLC

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# **Summary**

# Big Data and Machine Learning 'revolution':

- Real time : number of customers visiting, transactions, agricultural yields, activity of oil rigs
- useful data are not readily available and one needs to purchase, organize and analyze alternative datasets in order to extract tradeable signals.
- Machine Learning techniques requires some theoretical knowledge and a lot of practical experience in designing quantitative strategies.

# **Datasets and Methodologies:**

- acquiring, understanding AND technologies, methods
- data generated by individuals (social media posts, product reviews, search trends, etc.),
- data generated by business processes (company exhaust data, commercial transaction, credit card data, etc.)
- data generated by sensors (satellite image data, foot and car traffic, ship locations, etc.).
- <== these datasets need a level of analysis before they can be used in a trading strategy.
- different asset classes
- different investment styles (e.g. macro, equity long-short, etc.).

# **Summary**

# Fear of Big Data and Artificial Intelligence:

- Strategies based on Machine Learning and Big Data also require market intuition, understanding of economic drivers behind data, and experience in designing tradeable strategies.

# How will Big Data and Machine Learning change the investment landscape?

- We think the change will be profound.
- Eventually, 'old' datasets will lose most predictive value and **new datasets** that capture 'Big Data' will **increasingly become standardized.**

## (old data: quarterly corporate earnings, low frequency macroeconomic data, etc.)

- Machine Learning techniques will **become a standard tool** for quantitative investors and perhaps some fundamental investors too. (risk premia, trend followers, equity long-short quants, etc.)
- datasets that have high Sharpe ratio signals (viable as a standalone funds) will disappear.
- the **bulk of Big Data signals** will not be viable as stand-alone strategies, but will still be very valuable in the **context of a quantitative portfolio**.

# **Summary**

# Potential Pitfalls of Big Data and Machine Learning:

- Certain types of data may lead into blind alleys (datasets that don't contain alpha, signals that have too little investment capacity, decay quickly, or are simply too expensive to purchase)
- Managers may invest; complex models and architecture that don't justify marginal performance improvements.
- Machine Learning algorithms cannot entirely replace human intuition. (overfit, underfoot)
- it is more important to understand the **economics behind data and signals**, than to be able to develop complex technological solutions. (**not lead to viable trading strategies.**)

#### **Roles of Humans and Machines:**

- for short term trading, such as high frequency market making, humans already play a very small role.
- On a **medium term** investment... Machines have the ability to quickly analyze news feeds and tweets, process earnings statements, scrape websites, and trade on these instantaneously. These strategies are already eroding the advantage of **fundamental analysts**, **equity long-short managers and macro investors**.
- On a long term horizon, machines will likely not be able to compete with strong macro and fundamental human investors.

Figure 3: Classification of Big/Alternative Data sources

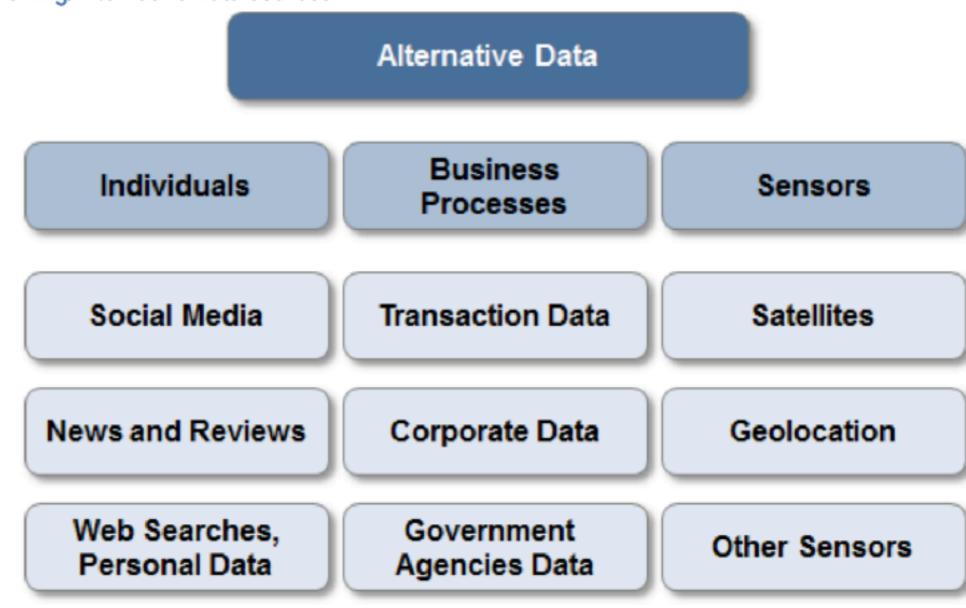


Figure 11: Typical length of history for alternative data sets

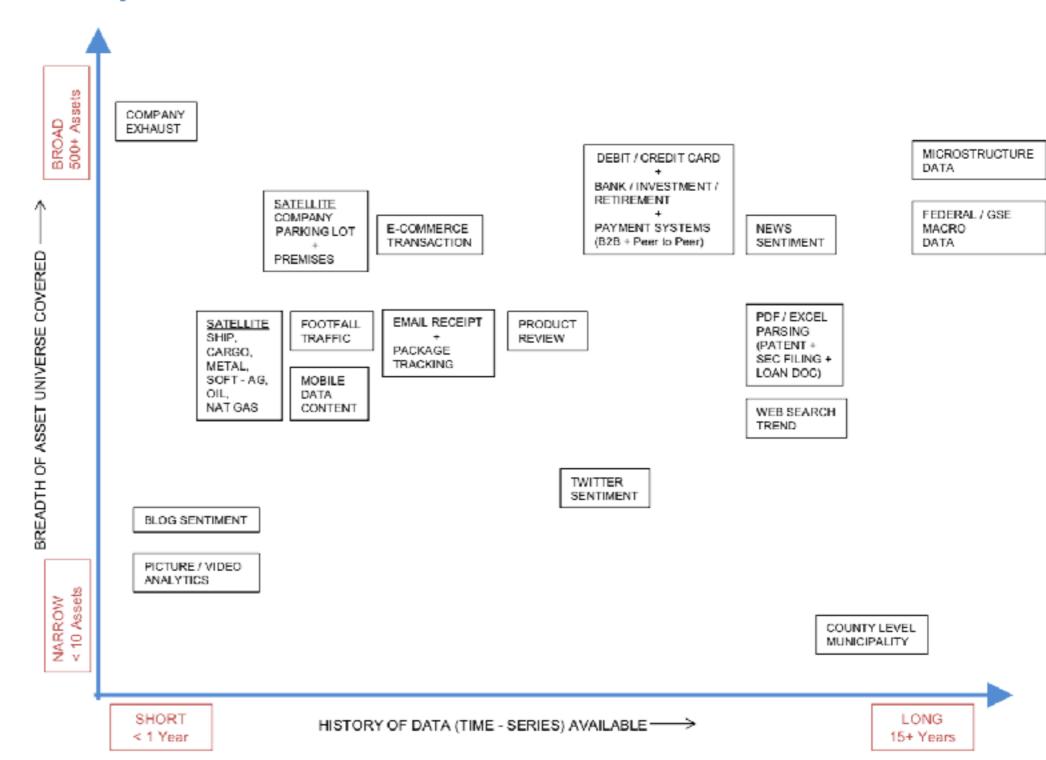
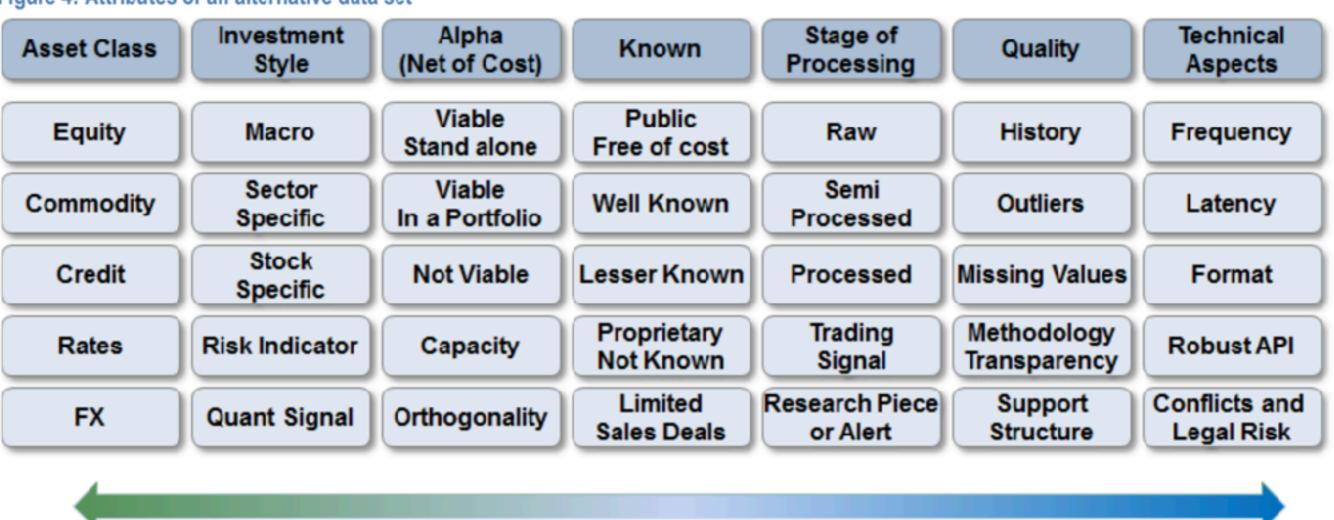


Figure 4: Attributes of an alternative data set



CIOs and Portfolio Managers

Quants and Data Scientists

- 1) Asset class. Most Big Data are still focused on equities and commodities.
- 2) **Investment style** most data are sector and stock specific and relevant for equity long- short investors.
- 3) **Alpha content**. Alpha content has to be analyzed in the context of the price to purchase and implement the dataset. Trading strategies based on alternative data are tested, and Alpha is estimated from a backtest. These tests can find whether a dataset has enough alpha to make it a **viable standalone** trading strategy. **Figure 5:** Information content of an alternative data set

Big / Alternative Datasets "Due Diligence" Unlikely Available for Purchase More Legal Risk Viable as Stand Higher Decay Alone Sharpe Limited Capacity Not Viable as Stand Alone Sharpe Available for Purchase Sharpe Ratio Viable in a portfolio Should be Valued based on: Stand alone Sharpe Ratio context for quants Correlation to other signals Capacity / Decay additional datapoints for discretionary managers Available for Purchase Should be avoided No Value

- 4) **How well-known is a dataset**. The more broadly a dataset is known, the less likely it is to lead to a stand-alone strategy with a strong Sharpe ratio. **Well-known public datasets** such as financial ratios (P/E, P/B, etc.) likely have fairly low alpha content and are not viable as a standalone strategies.
- 5) **Stage of processing** of data when acquired. Fundamental investors prefer processed signals and insights instead of a large amount of raw data. The highest level of data processing happens when data is presented in the form of **research reports**, alerts or trade ideas.
- 6) Quality of data is another important feature, especially so for data scientists and quants.
- 7) **Technical Aspects** of a big and alternative datasets.

## Classification of Machine Learning Techniques

Figure 6: Illustration of different Machine Learning / Al categories

Output /
Forecast of complex concepts and patterns

Output / Forecast returns

Output / Explain returns Find Relationships and patterns Turning Points, Crises, etc.

Output Sell if Triggered Finding the Best Model 0.2\*3M+ 0.7\*12M -0.1\*1M

Establishing the Relationship Factor weights Complex Concepts and representations Regimes, Non-Linear Links

Instruction '2% Stop Loss' Selecting Variables Momentum Various Lookbacks 1M, 3M, 6M, etc. Selecting
Variables and
Representation
Momentum, Carry,
Value, Volatility

Build Simple concepts and representations Risk Factors

Input Variables Asset Price Input Variables Price History Input Variables
Price History
Multiple assets

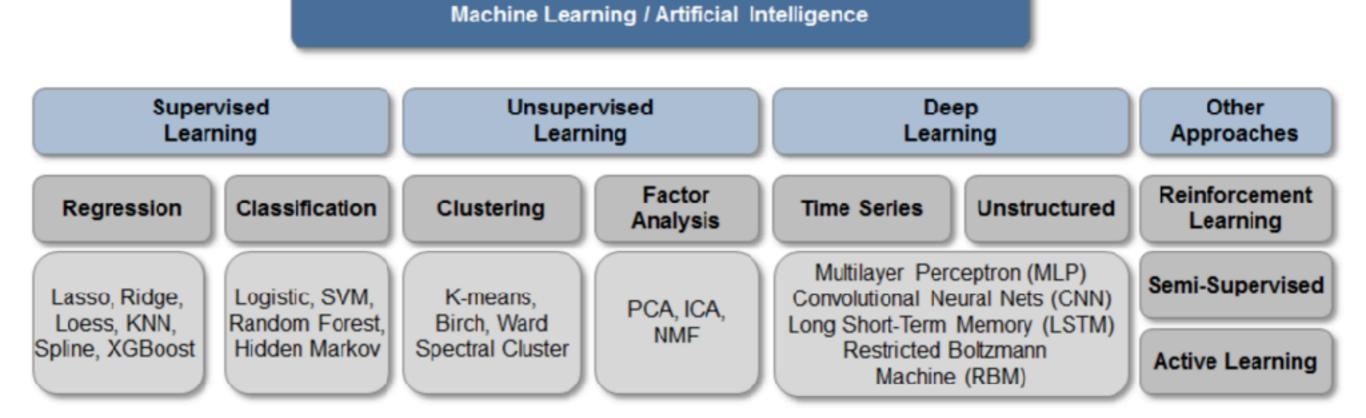
Input Variables Prices, Macro data, Unstructured data, etc.

Automation 'Symbolic Al' Classical ML Supervised

Classical ML Unsupervised Deep Learning

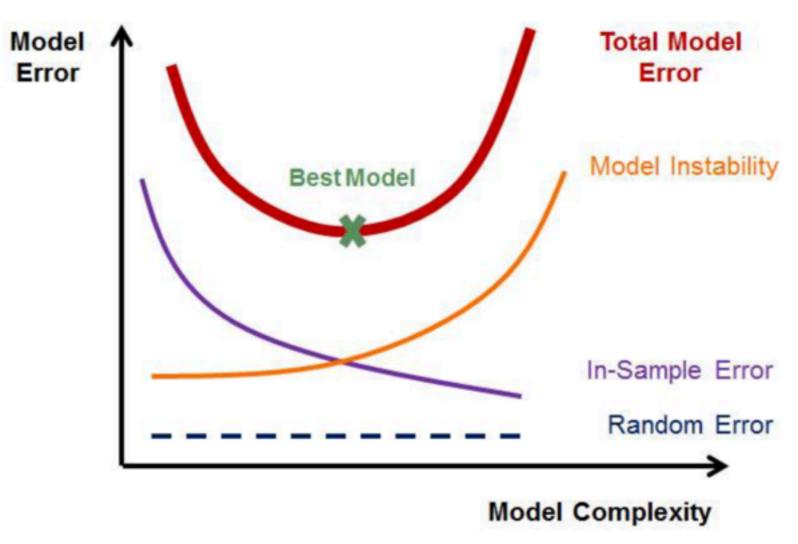
#### **Classification of Machine Learning Techniques**

Figure 7: Classification of Machine Learning techniques



## **Classification of Machine Learning Techniques**

Figure 8: Tradeoff between 'model bias' and 'model variance'



### Positioning within the Big Data Landscape

Figure 9: Big Data workflow for investment managers

