

THE IMPACT OF AI TALENTS ON HEDGE FUND PERFORMANCE

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MOTIVATION

THE WALL STREET JOURNAL.

Letting the Machines Decide

New Wave of Investment Firms Look to 'Artificial Intelligence' in Trade Decisions

By Scott Patterson

Updated July 13, 2010 12:01 am ET

Bloomberg

**The Massive Hedge
Fund Betting on AI**

Forbes

Feb 15, 2019, 01:48am EST | 18,821 views

**The Revolutionary Way Of
Using Artificial Intelligence In
Hedge Funds**

MOTIVATION

Machines have succeeded in many tasks

- Image recognition
- Text interpretation and translation
- Game playing
- Automatic driving

Artificial Intelligence sweeps in hedge fund industry

- *"Over half of hedge fund respondents (56%) used AI to inform investment decisions – nearly triple the 20% reported a year earlier"*
- *"Around two-thirds of those using AI were doing so to generate trading ideas and optimize portfolios"*
 - BarclayHedge's Hedge Fund Sentiment Survey (2018)

EXAMPLE OF HEDGE FUNDS ADOPT AI TECHNIQUES

Marshall Wace combines alternative data and AI to generate investment ideas

- Satellite images of parking lots
- Mobile phone geolocations



RESEARCH OBJECTIVES

Research Questions

- 1 Can AI help hedge funds improve performance?
- 2 Can AI help hedge funds manage risk?
- 3 Will AI affect hedge funds' trading behavior?

Challenges

- It is hard to observe:
 - whether hedge funds adopt AI techniques
 - when hedge funds adopt AI techniques
 - the extent of AI adoption
- Could be just for the purpose of advertising

RESEARCH OBJECTIVES

Identify through employment of AI talents

- Most of employees are available on social network
- Multi-dimension of employee profile

Big Data Engineer at Marshall Wace
London, England, United Kingdom · [Contact info](#)

About

I am a senior Big Data engineer with valuable transferable skills, knowledge and experience gained within blue chip financial institutions. I have been noted and commended for excellent technical knowledge, superb analytical skills and timely project delivery. I firmly believe in Agile methodologies and quality software design.

- Big Data expert. Proficient Scala/Spark/Hadoop developer. Always focused on delivering business value and tangible results. Clean coder. Agile believer. Strong communicator.
- Keen interest in all things Big Data, Machine Learning and AI.

Experience



Big Data Engineer

Marshall Wace · Full-time
Mar 2020 – Present · 1 yr 3 mos
London, England, United Kingdom



Director

Thomson Limited
Jul 2014 – Jun 2020 · 6 yrs



Big Data Engineer

Pollinate International
Jun 2019 – Feb 2020 · 9 mos
Technologies: Scala, Spark (Spark SQL, Dataframe API, Spark Streaming), Databricks, Kafka

Education



Warsaw University of Technology
Master's Degree, Computer Science
2005 – 2010



Technische Universität München / Technical University of Munich
2009 – 2009

ATHENS programme: one week intense course on simulation in computer science

Skills & endorsements

Scala · 8



Endorsed by Victor Svistunov, who is highly skilled at this

Big Data · 5

Conor Class and 4 connections have given endorsements for this skill

FINDINGS

Employment of AI talents is associated with annual improvement of alpha by 2.64%, and the improvement is more pronounced when:

- AI employees have previously worked in the tech industry
- AI employees earned a Ph.D. degree

AI improves the procedure of portfolio optimization and risk management

- Reduction in total fund risk
- Increase in the Sharpe ratio and information ratio

Employment of AI talents change funds' trading behavior

- Funds hold a larger number of securities
- Fewer local stocks
- Shift more weights on certain industry such as consumer goods industry

CONTRIBUTIONS

Factors Affected Hedge Fund Performance

- Managers (e.g., Li, Zhang, and Zhao 2011), Fund Characteristics (e.g., Teo 2009; Aggarwal and Jorion 2010), Financial Contracting Mechanisms (e.g., Agarwal, Daniel, and Naik 2009), Redemption Restrictions (e.g. Aragon 2001; Aragon, Martin, Shi 2019), and Regulatory Disclosures (e.g. Shi, 2017)

Technology Innovation on Firm Value and Productivity

- Firm growth and industry concentration (e.g., Kogan, Papanikolaou, Seru, and Stoffman 2017, Babina, Fedyk, He, and Hodson 2021), Labor Market (e.g., Grennan and Michaely 2021), Credit Market (Fuster, Goldsmith-Pinkham, Ramadorai, and Walther 2020), Equity Analysis (Grennan and Michaely 2020)

CONTRIBUTIONS

Human Capital on Firm Outcomes

- Public Firm Return (Fedyk and Hodson 2020), Marketing (Kostovetsky and Manconi 2018)

DATA AND FEATURES

Fund Return and Characteristics from Union Hedge Fund Data

- EurekaHedge, HFR, Morningstar, and Lipper TASS

Fund Holding and Location from 13F, CRSP, and WhaleWisdom

- Classify hedge fund firms manually following Agarwal, Fos, and Jiang 2013

Information of AI Talents from Hand Collect Data from LinkedIn

- Companies under three industries: Financial Service, Capital Market, and Investment Management
- Omit large financial companies with more than 200 current employees
- Manually match to IDs in the Union Hedge Fund Data and 13F separately based on name, location, and key person in the company
- Including Title, Introduction, Employment History, Education, Skills, Endorsement, Interest, etc

IDENTIFY AI TALENTS

Search current and previous employees of hedge fund companies in the matched sample that contains AI-related keyword

AI keywords: Glossary of Artificial Intelligence from Wikipedia

- **AI and Synonyms:** Artificial Intelligence, AI, A.I.
- **Sub-field under AI:** Deep Learning, Machine Learning, Association Rule Learning, Reinforcement Learning, Natural Language, Big Data, etc
- **Techniques used in AI:** Decision Tree, Random Forest, K-means, Apriori, eclat, Word Embedding, Bag-of-words, Neural Network, K-fold Cross Validation, NLP, etc
- **Softwares specifically for AI developers:** Tensorflow, Pytorch, etc

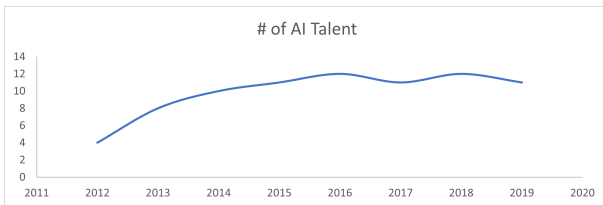
IDENTIFY AI TALENTS

Separate targeted employees into:

- **AI Employee:** Employee with AI-related word in job title or job description.
e.g. Data Scientist currently on machine learning projects
- **AI Candidate:** Employee with AI-related word in Introduction, Education, Top-10 Endorsed Skills

Define AI Hedge Fund Company with at least one AI Employee and:

- **More than 50 employees:** Three AI Employee and AI Candidates
- **10 - 50 employees:** Two AI Employee and AI Candidates
- **Less than 10 employees:** One AI Employee and AI Candidates



SUMMARY STATISTICS

	Union Sample	13F Sample
<i>All Fund Companies</i>	5643	1872
<i>Companies in LinkedIn</i>	1229	765
<i>AI Companies in LinkedIn</i>	226	55

	AI Funds			Non-AI Funds		
	N	Mean	Median	N	Mean	Median
<i>Management Fee (%)</i>	1,091	1.51	1.5	5,893	1.44	1.5
<i>Incentive Fee (%)</i>	1,091	15.85	20	5,893	14.92	20
<i>Leveraged</i>	1,091	15.52	1	5,893	6.96	1
<i>Lockup (day)</i>	1,091	62.23	0	5,893	70.68	0
<i>Redemption Frequency (day)</i>	1,091	46.27	30	5,893	54.10	30
<i>Redemption Advance Notice Period (day)</i>	1,091	28.07	30	5,893	30.79	30
<i>High Water Market</i>	1,091	0.76	1	5,893	0.68	1
<i>Hurdle Rate</i>	1,091	0.24	0	5,893	0.22	0

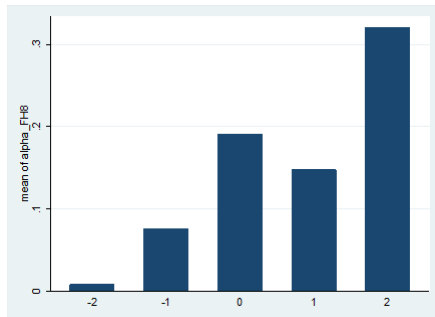
STYLE BREAKDOWN

- Funds with style of Relative Value, Global Macro, CTA are more likely to adopt AI techniques

	AI Fund		Non-AI Fund		Difference
	# of Funds	%	# of Funds	%	%
<i>Long Short</i>	333	32.78	1,844	36.35	-3.57***
<i>Relative Value</i>	174	17.13	750	14.78	2.34***
<i>Global Macro</i>	162	15.94	420	8.28	7.67***
<i>CTA</i>	119	11.71	190	3.75	7.98***
<i>Multi Strategy</i>	65	6.40	373	7.35	-0.96
<i>Long Only</i>	58	5.71	451	8.89	-3.18***
<i>Event Driven</i>	44	4.33	404	7.96	-3.63***
<i>Market Neutral</i>	25	2.46	112	2.21	0.25
<i>Other</i>	20	1.97	315	6.21	-4.24***
<i>Emerging Markets</i>	14	1.38	203	4.00	-2.62***
<i>Short Bias</i>	2	0.20	11	0.22	-0.02

AI TALENTS ON FUND PERFORMANCE

- The performance of Hedge funds improves after adopting AI techniques



	Pre-AI			Post-AI			Difference
	# obs.	mean	sd	# obs.	mean	sd	
<i>Eight-Factor Model Alpha</i>	9,619	0.04	4.20	7,317	0.23	3.65	0.19***

AI TALENTS ON FUND PERFORMANCE

- The performance of Hedge funds improves after adopting AI techniques

	<i>Fung-Hsieh Eight-Factor Alpha</i>	
$AI_{i,t}$	0.233** (2.410)	0.220** (2.258)
$Fundsize_{i,t-1}$		-0.264*** (-4.500)
$Fundsize_{i,t-1}^2$		0.139*** (2.492)
$Logfundsize_{i,t-1}$	-0.190*** (-8.030)	
Fund fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Observations	324,757	325,082
R-squared	0.055	0.054

CROSS-SECTION OF FUND PERFORMANCE

- Performance improvement is concentrated among funds with
 - greater percentage of AI employees
 - AI employee with Ph.D. degree
 - AI employee from tech industry
 - fund styles that have less AI competition

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Fung-Hsieh Eight-Factor Alpha</i>							
	Percentage of AI Employee		AI Employee with a Ph.D.		AI Competitiveness		Transferred from Tech Industry	
	High	Low	Yes	No	High	Low	Yes	No
$AI_{i,t}$	0.32*** (2.61)	0.02 (0.15)	0.29** (2.50)	0.03 (0.22)	0.12 (0.77)	0.30*** (2.70)	0.36** (2.56)	0.06 (0.43)
$Logfundsize_{i,t-1}$	-0.18*** (-7.66)	-0.19*** (-7.21)	-0.18*** (-7.73)	-0.19*** (-7.12)	-0.24*** (-7.64)	-0.20*** (-6.21)	-0.18*** (-7.66)	-0.19*** (-7.31)
Fund fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	304,359	285,847	305,070	285,136	93,694	231,011	294,393	301,938
R-squared	0.05	0.06	0.05	0.06	0.09	0.06	0.05	0.06

AI TALENTS ON PORTFOLIO OPTIMIZATION

- AI could be a potential solution to the optimization challenge
 - Kinn 2018, Ban, Karoui, and Lim 2018
- AI technology improves the efficiency of funds' portfolio diversification

	(1) <i>Total Risk</i>	(2) <i>Market Risk</i>	(3) <i>Idiosyncratic Risk Carhart4</i>	(4) <i>Idiosyncratic Risk FH8</i>
$AI_{i,t}$	-0.002*** (-2.923)	0.008 (0.465)	-0.002*** (-3.480)	-0.001*** (-2.746)
$Lagfundsize_{i,t-1}$	-0.000* (-1.757)	-0.000** (-2.215)	-0.000** (-2.323)	-0.000* (-1.925)
Fund fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	291,925	291,925	292,284	292,284
R-squared	0.769	0.710	0.748	0.731

AI TALENTS ON PORTFOLIO OPTIMIZATION

- AI could be a potential solution to the optimization challenge
 - Kinn 2018, Ban, Karoui, and Lim 2018
- AI technology improves the efficiency of funds' portfolio diversification

	(1) <i>Sharpe Ratio</i>	(2) <i>Info Ratio Carhart4</i>	(3) <i>Info Ratio FH8</i>
$AI_{i,t}$	0.099** (2.503)	0.124*** (2.792)	0.123** (2.193)
$Lagfundsize_{i,t-1}$	-0.000*** (-5.989)	-0.000*** (-5.399)	-0.000*** (-5.458)
Fund fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	291,887	291,887	292,182
R-squared	0.254	0.212	0.187

AI TALENTS ON FUND INVESTMENT BEHAVIOR

Allow funds to process a large amount of information

- Hedge funds hold a greater number of securities

Use alternative and unstructured data to generate investment ideas

- Hedge funds invest more in the sector with more unstructured and alternative data

Rely more on public information

- Hedge funds hold less local stocks

AI TALENTS ON FUND INVESTMENT BEHAVIOR

Allow funds to process a large amount of information

- Hedge funds hold a greater number of securities after the employment of AI talents

	(1)	(2)
	<i>Log of Number of Holding</i>	
$AI_{i,t}$	0.31** (2.17)	1.33*** (48.81)
$Logcompanysize_{i,t-1}$	0.32*** (18.75)	0.37*** (98.36)
Company FE	Yes	No
Time FE	Yes	Yes
Observations	29,715	29,718
R-squared	0.90	0.31

AI TALENTS ON FUND INVESTMENT BEHAVIOR

Use alternative and unstructured data to generate investment ideas

- Hedge funds invest more in the industry that allow AI build information advantages from massive public information

	(1) <i>Consumer Goods</i>	(2) <i>Health Care</i>	(3) <i>Utility</i>	(4) <i>Financial</i>	(5) <i>Real Estate</i>
$AI_{i,t}$	0.78** (2.53)	0.68 (1.53)	-1.09 (-1.41)	-0.36 (-0.23)	0.16 (0.21)
$\text{LogCompanySize}_{i,t}$	-0.53*** (-2.97)	-0.70*** (-3.43)	0.14 (0.35)	-1.97*** (-6.31)	-0.83*** (-3.08)
Observations	15,460	15,708	16,363	23,990	9,169
R-squared	0.71	0.47	0.63	0.68	0.63

AI TALENTS ON FUND INVESTMENT BEHAVIOR

Rely more on public information

- Hedge funds hold fewer local stocks after the employment of AI talents

	(1) <i>Log Distance</i>	(2) <i>Within 50km</i>	(3) <i>Within 100km</i>	(4) <i>Within 200km</i>
$AI_{i,t}$	0.060*** (6.799)	-0.009*** (-3.726)	-0.005* (-1.722)	-0.008** (-2.548)
$Logcompanysize_{i,t-1}$	0.013*** (3.522)	0.002*** (4.010)	-0.001 (-0.989)	0.001 (1.484)
Observations	22,093	22,093	22,093	22,093
R-squared	0.008	0.005	0.005	0.006

ROBUSTNESS

- Performance improvement is associated with adopting AI technique but not algorithm trading

	(1)	(2)
	<i>Fung-Hsieh Eight-Factor Alpha</i>	
$AI_{i,t}$	0.24** (2.46)	
$Algorithmictrading_{i,t}$	-0.03 (-0.42)	-0.02 (-0.24)
$Logfundsize_{i,t-1}$	-0.19*** (-8.02)	-0.19*** (-7.98)
Observations	324,757	324,757
R-squared	0.055	0.055

ALTERNATIVE PERFORMANCE MEASURE

- Performance improvement is revealed in alternative performance measures

	(1) <i>Raw Returns</i>	(2) <i>Market Model</i>	(3) <i>FF3</i>	(4) <i>Carhart4</i>	(5) <i>Carhart + Liq</i>	(6) <i>FH7</i>	(7) <i>Style Adjusted</i>
$AI_{i,t}$	0.18* (1.69)	0.22** (2.44)	0.19** (2.12)	0.19** (2.06)	0.20** (2.07)	0.26*** (2.68)	0.15* (1.88)
$Logfundsize_{i,t-1}$	-0.22*** (-9.66)	-0.20*** (-8.21)	-0.17*** (-7.33)	-0.17*** (-7.94)	-0.16*** (-7.38)	-0.20*** (-7.93)	-0.21*** (-10.52)
Observations	362,365	324,787	324,787	324,787	324,787	324,767	362,365
R-squared	0.16	0.09	0.08	0.08	0.07	0.08	0.03

CONCLUSION

- **Employment of AI talents improves the annual performance**
 - 2.64% of alpha annually
 - The improvement is more pronounced when funds hire more AI talents, adopt deeper AI techniques, and in styles with less competition
- **AI improves the procedure of portfolio optimization and risk management**
 - Reduction in total fund risk
 - Increase in the Sharpe ratio and information ratio
- **Employment of AI talents changes funds' trading behavior**
 - Allow fund to process a large amount of information
 - Use Alternative and unstructured data to generate investment ideas
 - Rely more on public information