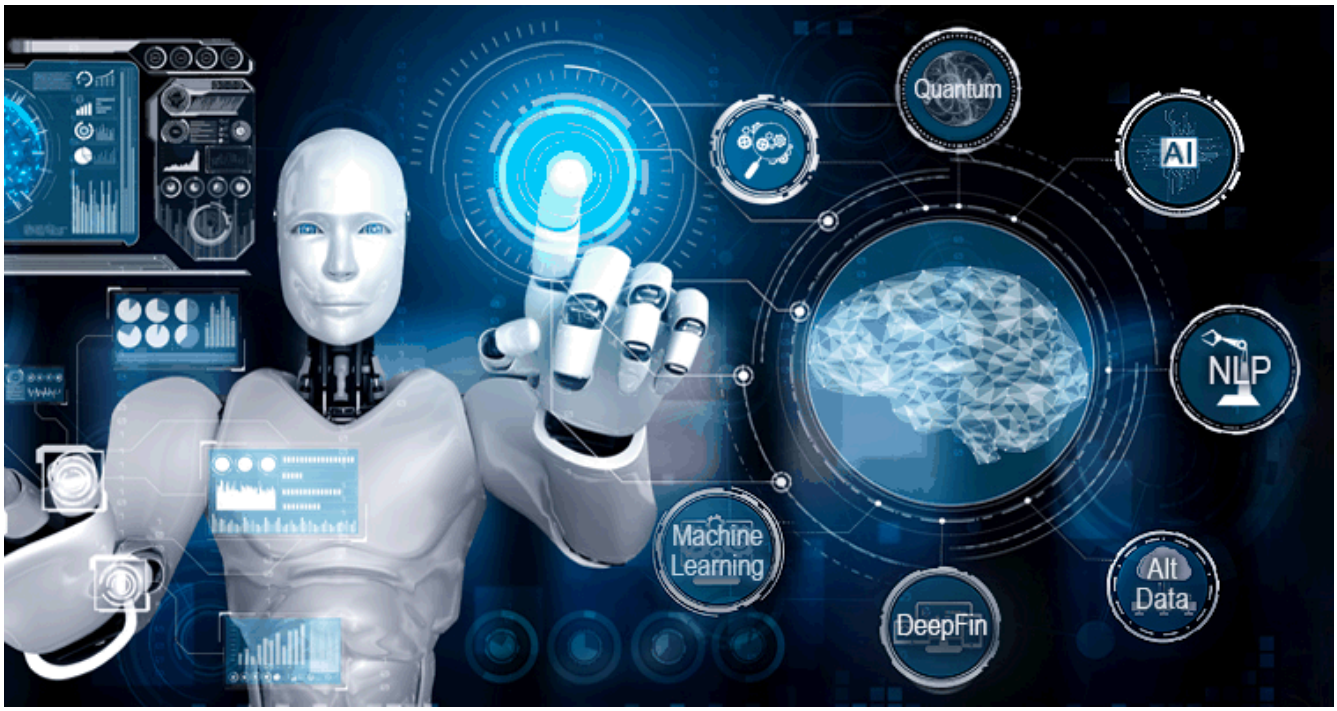
Big Data and AI Strategies

Summary of JPM Research as well as academic and industry developments in 2H21



Big Data and AI Strategies

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Executive Summary

The J.P. Morgan research team continues to use alternative sources of Big-Data to help guide our investment advice using Machine Learning, Artificial Intelligence, with an increasing reliance on NLP tools. Following the discussion of our industry leading research products summarized in this report, we include highlights from investor and industry conferences. The final section includes an update on broad industry and academic developments over the past six months.

We highlight reports published by the various Research teams across J.P. Morgan in 2H21. A full listing of past reports on Alt-Data, Machine Learning and Artificial Intelligence can be found in the 1H21, 2H20, 1H20, 2H19, 1H19, 2H18, 1H18 and 2017 summaries. These summaries follow the 280-page book Big Data and AI Strategies: Machine Learning and Alternative Data, which introduced these concepts when it was published in mid-2017. All of our Machine Learning reports are available on the BigData portal or by searching the J.P. Morgan Markets website.

J.P. Morgan Research Highlights

For this report we have turned our machine learning tools inward, using web-scraping to extract over 26,000 published reports from the JPMM.com website API. Using elements from our Smart-Buzz NLP tools we filter these down to the most relevant 65 reports flagged in the Alt-Data, ML and NLP sections. A selection of these reports drawn from the broad J.P. Morgan research teams are highlighted here.

We wrote a case-study on how to leverage quantitative methods, macro views and a host of traditional and alt-data to run a variety of systematic macro frameworks and data-driven tools that can be used in portfolio positioning, idea generation, risk management, ESG and diversification in the Help us help you report.

Alt-Data continues to be a useful tool to analyse stocks, such as a report on the link between consumer risk awareness and lost revenues in the China insurance market or using commuter survey data and AlphaSense NLP to assess HealthEquity. Bumble was boosted to OW with support from AppTopia data and ML analysis.

We used Machine Learning (ML) to understand the probability of technical trading impacting markets in a series of FX and Equity Technical Strategy reports. We introduced the Adaptive Regime Compass for AsiaPac and another for Australia which compare current equity markets to similarities in history using ML Algorithms and we continued a series of Machine Learning Based Trade Recommendations reports.

Thematic investing is an area uniquely suited to NLP tools and we have been active in this area. We update our "SmartBuzz 2.0" framework with a News based dividend factor example and we measure the topicality of LDP election candidates' policy proposal using NLP.

We looked at State of the Art NLP Tools with Practical Financial Applications such as Thematics, Summarisation, Q&A including a podcast and DeepFin zoom recording and another with nVidia covering "Natural Language Modelling with Deep Learning and GPUs".

We used Alexandria NLP data to examine Retail Sentiment and Order Flow and used transcripts data in a series of India Equity Strategy reports subtitled: The Research Robot.

NLP models can also be used to update the Hawk/Dovishness scores of the FOMC speakers in The beat goes on while a similar technique can be applied to public comments made by Federal Reserve officials in "Interest Rate Derivatives: Pay no attention to that convexity behind the curtain".

We also published a three-part series on China ESG Data that looked into: Data Privacy Laws, Controversial Events and Greenwashing all using NLP and other ML tools.

Academic and Industry Research Highlights

We continue to track a variety of interesting developments across the spectrum of AI, ML, Big/Alt-Data, Quantum, Algorithm, Software, Hardware, Wetware as well as Neuroscience fields.

The average human brain contains 86Bn neurons each of which has between 1,000 and 10k connections (on average but some neuron types have up to 200k), we would expect somewhere in the range of 86Tn to a Quadrillion (10^{15}) connections (however there is redundancy in these connections). While neural networks started with a simple mathematical approximation of a single neuron (Rosenblatt's Perceptron) we are also reading about an extended line of research that studies these vast connections. Starting with a tiny worm with just 302 neurons, mapping the full 'connectome' has proven a challenge. The Human Connectome Project aims to do this over a decade long project. A collaborative effort between Harvard and Google has generated the highest resolution image of the brain to date. Their image gallery is spectacular. This line of research has implications for the next generation of neural net nodes.

Meanwhile, the race to bigger and bigger artificial neural networks continues. Last year GPT-3 was the undisputed leader with 176Bn parameters in a traditional layered network. In January Google upgraded T5 to "XXL" giving the Mixture of Experts model 1.6Tn parameters. Then Wu Dao 2.0 claimed the record of being the largest mixed-mode-model with a striking 1.75 trillion parameters. Only to be beaten by M6 from Alibaba DAMO Academy with 10Tn parameters. Alibaba claim their Multi-Modality to Multi-Modality Multitask Mega-transformer consumes just 1% of the energy of GPT-3 to train. DeepMind also released Gopher with 280Bn parameters and a paper on training efficiency. They are not alone as EfficientNetV2 from a Google research team focuses on reducing model size, shorter training time and electricity efficiency, too.

These models are getting close to the scale and design of the human brain, with different 'regions' used for different but related tasks like a visual model partially connected to a linguistic model and so on.

A handful of these very large models are a few percent smarter than humans at general language skills, according to the SuperGlue leaderboard. And they may be conscious…more on this later.

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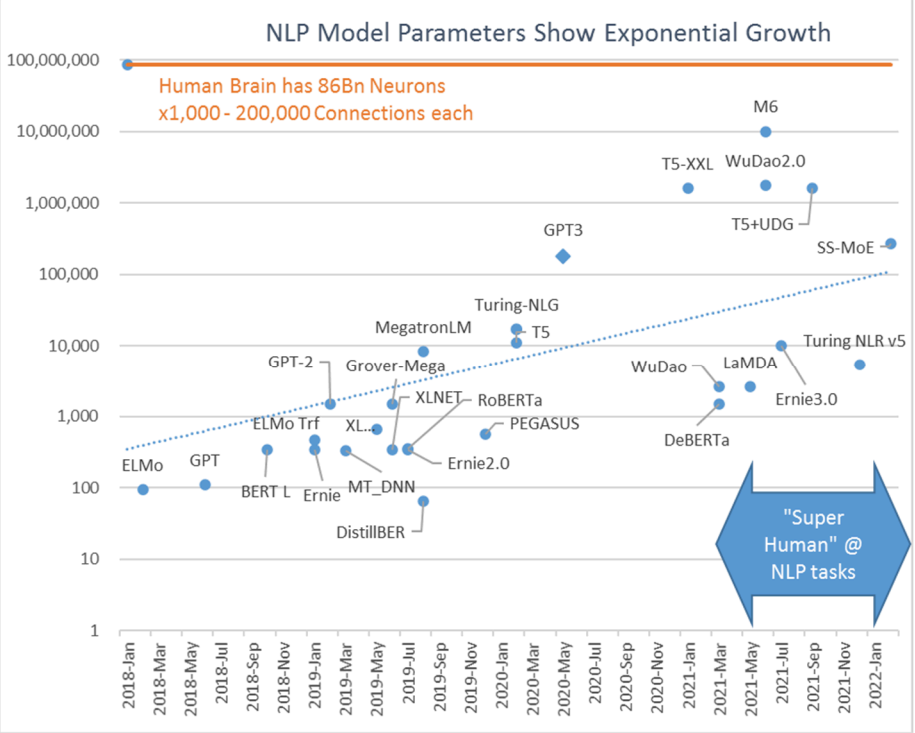
Figure 1: Artificial Intelligence Model Size Showing Exponential Growth



Source: J.P. Morgan BigData & AI Strategies

Within a year or two we can expect models to have 100Tn parameters (such as GPT-4 according to the internet sources). This will put the AI model parameter count in the same capacity as the human brain (low estimates), but requiring racks of super computers, perhaps running entire wafer CPUs. But it is worth noting that the mega-networks have reached a point where added scale doesn't necessarily improve accuracy, so a lot of the new models are multi-modal using techniques such as mixture of experts, like the Switch Transformers by Google. CLIP uses contrastive learning to embed text and images in the same high-dimension space.

To address the massive inefficiencies of artificial neural networks, another branch of research is being taken with the aim of programing smaller models with more advanced algorithms or smarter training approaches. For example, Baidu research trained ERNIE 3.0 the 10Bn parameter model to predict universal knowledge answers by feeding the model 4Tb of knowledge graph data, with some answers masked. As a result, ERNIE3 has built up a factual knowledge base to assist when answering questions that might need to incorporate knowledge outside the context provided. Research into the design of deep neural nets is also using AI, with HyperNetworks able to pre-program the model parameters of acceptably performant models in one pass, cutting training time dramatically.

One of the big problems training any ML model is getting access to labelled training data. There is a big focus on reducing this dependency by using pretrained models or semi- and self-supervised learning paradigms. Facebook and Salesforce unveiled research efforts that leverage softer forms of supervision for areas such as speech analysis and code generation respective (Sequence). Self-supervised learning (SSL) used by FAIR SSL in data2vec is a general solution that is equaling or beating dedicated models in benchmark tests across different modalities.

OpenAI's lead researcher, Ilya Sutskever, created a buzz when he claimed that AI may already be gaining consciousness in a tweet, and covered in this ScienceTimes article. With some new mega-models getting close to the scale of the human brain, these claims may not be so far-fetched.

Computer vision recently borrowed the transformer modelling ideas from NLP. Now much simpler "MLP-Mixers…" are (nearly) matching the performance of Vision Transformers, but only using Multi-Layer Perceptrons and are easier to train as they don't need positional encodings. Adding convolutions gives ConvMixers that operate on patches, maintain resolution and size throughout all layers, avoiding bottlenecks, while performing channel-wise mixing and all fitting in a compact architecture.

Image de-noising, enhancement and deepfake creation continue to progress with tools like StyleGAN, GauGan, *VQ-VAEs and now* OpenAI's Denoising Diffusion model, Google's SR3 model and Palette capable of some spectacular imagery.

AutoML Tools and Services, often called "MLOps" is an area that has seen a lot of investment through 2021, with companies such as C3.ai one of the first ML companies to go public, along with DataRobot and Scale AI. We expect to see more in this area as tools become more useful and implementation at the business level easier. Companies like OpenAI with its API, Microsoft with Cognitive Services, Google, Meta (Facebook), will all continue to push Business Process Automation (BPA), partially driven by a skill and/or worker shortage.

Low-Code and No-Code systems are becoming more useful and gaining traction (including at J.P. Morgan). Systems like Pega, ServiceNow and Unqork can help addresses simple workflows with little or no coding required. Coding tools like Codex promise to make software engineering easier and faster.

Software AI and Bots are becoming smarter (as we discussed in our SotA paper), and Robots becoming cheaper and more capable (see Robots section below). While specialist chat-bots are quite capable of answering routine enquiries or specific problems, 'master-bots' with more capabilities are likely to prove more useful in the real-world by combining skills such as audio and chat capabilities over long-running interactions.

ML-Hardware has been developing despite the silicon chip shortages. We continue to see rapid development of hardware from the usual players, as well as newcomers like Apple (M1 and later chips), Google, Tesla and so on. It is also interesting/concerning that AI is being used to design AI, with hardware manufacturer Samsung using AI to design their latest chips.

Looking ahead we expect to see more announcements about AutoML coding tools (no-code ML) and mega-models this year. See this Towards Data Science article for more non-obvious trends of the ML market in 2022 and for more on the Top Deep Learning Papers of 2021, see this Medium article.

2H21: J.P. Morgan Equity Research

We use the following categories to highlight our most relevant Global Research; Alternative Data, Machine Learning (ML), Natural Language Processing (NLP). For 2H21, a total of 26,000 reports across the firm have been filtered down to the 65 most relevant reports across the research teams. We have included repeated periodicals and trackers, citing just a single-entry and skip survey based reports.

Alt-Data & Data-Driven Reports

Source: iStockPhoto

Investment analysis has always been driven by data. The reports flagged in this section have made use of new and/or novel 'Alt-Data' to help drive stock ratings and earnings estimates, or separate potential over-weights from under-weights in a portfolio context. The J.P. Morgan Equity Research teams have adopted widespread use of specialist data series across all sectors, highlighted in the 'Data-Driven' reports, of which we flag about a third below.

MW Kim and Alex Yao examined the link between consumer risk awareness and lost revenues in the China insurance market using an alt-data analysis which included Baidu keyword search trends.

Mixo Das wrote a case-study on how to leverage quantitative methods, macro views and a host of traditional and alt-data to run a variety of systematic macro frameworks and data-driven tools that can be used in portfolio positioning, idea generation, risk management, ESG and diversification in the "Asia Quantamental Strategy: Help us help you" report.

In "HealthEquity: Get Back to Work! Commuter Survey Points to Post Labor Day Acceleration But Delta May Push" Anne E. Samuel used a combination of commuter trends data, original survey responses and AlphaSense NLP data.

Cory A Carpenter wrote on Bumble, which he Boosted to Overweight with support from AppTopia data and ML analysis.

While not directly using alt-data, there were some interesting takeaways from the FinTech chats held by Harsh Modi with some of the Asia Digital Finance stocks in his report: "Asia Digital Finance: 'Customer delight' and takeaways from FinTech chats"

The remaining articles typically review companies that are using alt-data in their business.

Team	Lead AC	Title
Quantitative & Derivatives Strategy	**Mixo Das**	**Asia Quantamental Strategy: Help us help you**
Managed Health Care	**Anne E. Samuel**	**HealthEquity: Get Back to Work! Commuter Survey Points to Post Labor Day Acceleration But Delta May Push**
Life & Health Insurance	**MW Kim**	**China Insurance: Tracing the link between risk awareness and lost revenues: an alt-data analysis**
Wireless Telecommunication Services	Alexei Gogolev	Mobile Telesystems: Remain OW on possible infrastructure sale and focus on monetization of non-core services
Research & Consulting Services	Andrew C. Steinerman	Nielsen Holdings PLC: J.P. Morgan 2021 Ultimate Services Investor Conference Takeaways
Internet & Direct Marketing Retail	Ankur Rudra	Zomato: The Morning After, we upgrade to OW
Emerging Markets Research	Ben K Jarman	The Antipodean Strategist: Omicron, not omichronic
Internet Services & Infrastructure	Billy Feng	Sinnet - A: In-line 3Q21 performance; a relatively safe play in A-share IDCs
Internet Services & Infrastructure	Billy Feng	Sinnet - A: Potential beneficiary of stringent power control and recovering economy; maintain OW
Economic Research	Bruce Kasman	Global Data Watch: Please sir, I want some more
Airlines	Elena Jouronova	Moscow Talks: GAZP, LKOD, YNDX, DSKY, AFLT, MGNT and more
Equity Research	Elena Jouronova	Moscow Talks: ROSN, Export Duties, YNDX, F2M Tariffs, VEON and more
Quantitative & Derivatives Strategy	Haoshun Liu	AI and Big Data Approach to Thematic Investing: Assessing Japan digital transformation beneficiaries following the establishment of the Digital Agency
Semiconductors	Harlan Sur	Broadcom Inc: Software Analyst Day Highlights Strong Focus On Large Strategic Customers, Portfolio Breadth, And Solid Growth Outlook
Diversified Banks	**Harsh Wardhan Modi**	**Asia Digital Finance: 'Customer delight' and takeaways from FinTech chats**
Industrial Conglomerates	Jay Kwon	CJ Corp: Solid CJOY momentum, new mid-term strategy update, attractive NAV; new PT W130K
Diversified Banks	Katherine Lei	Ping An Bank - A: Key takeaway from corporate day is net positive
Restaurants	Kevin Yin	Nayuki Holdings Limited: A leading premium teahouse chain in China - Initiate coverage at OW
Biotechnology	Ling Wang	China Pharma Policy Update and Outlook: Views from a Healthcare Public Policy Expert
Economic Research	Michael S Hanson	Daily Economic Briefing: October surveys deliver declines
Integrated Telecommunication Services	Michelle Wei	China Unicom: Post-results investor call takeaways
Interactive Home Entertainment	Ranjan Sharma	Sea Ltd: Feedback from investors on sell-off post 3Q21
Quantitative & Derivatives Strategy	Ryota Sakagami	Japan Equity Strategy: Market Outlook and Investment Strategy: Expect Return to Value Market after Risk-Off Movement
Diversified Banks	Sofie Peterzens	Nordic banks: A digital deep dive, lagging the digital arms race - Nordea top-pick
Coal & Consumable Fuels	Soo Chong Lim	Asia Credit Roundup: Global Credits, China Strategy, China Credits, China Tech, Aoyuan, Adaro
Investment Banking & Brokerage	Wataru Otsuka	Financial Cross Sector: Considering Prospects and Potential for SBI/Shinsei Tender Offer
Interactive Media & Services	**Cory A Carpenter**	**Bumble: Boosting to Overweight; Mgmt Meetings Increase Our Confidence in Bumble App Trajectory, Product Roadmap, & BFF**

Source: J.P. Morgan research

Machine Learning Reports

Source: iStockPhoto

J.P. Morgan is actively applying Machine Learning techniques to analyse investment trends and patterns across all asset classes. A short list of the Big Data and AI Strategies team reports are featured on the QDS Big Data & AI portal on JPMorganMarkets.

Andreas Willi wrote a series of "Capital Goods Today" reports some of which address the Construction & Engineering sector company's activities in the ML space.

Jason Hunter used ML to understand the probability of technical trading impacting markets in a series of FX and "Equity Index Technical Strategy" reports.

Tony Lee Introduced the Adaptive Regime Compass: Measuring Equity Market Similarities with ML Algorithms for AsiaPac and another for Australia.

Peng Cheng continued his series of Cross Asset Volatility: Machine Learning Based Trade Recommendations reports.

Team	Lead AC	Title
Renewable Electricity	Alan Hon	China wind power – blowing in the wind: Applying AI to identify wind power stock opportunities – December generation growth likely in line with expectations
Construction & Engineering	**Andreas Willi**	**Capital Goods Today: 07 December 2021**
Quantitative & Derivatives Strategy	Davide Silvestrini	European Equity Derivatives Outlook: Dispersion update and single stock trade ideas
Quantitative & Derivatives Strategy	**Tony SK Lee**	**Asia Pacific Equity Derivatives Highlights: Introducing ARC model for Australia; AS51 hedging strategies**
Quantitative & Derivatives Strategy	**Tony SK Lee**	**Introducing the Adaptive Regime Compass: Measuring Equity Market Similarities with ML Algorithms**
FX Strategy	Dobromir Tzotchev	Quantitative Perspectives on Cross-Asset Risk Premia: Performance review, summary of the published research ideas in 2021, FX quant models 2022 outlook and latest model views
Fixed Income Strategy	**Jason Hunter**	**Equity Index Technical Strategy: S&P 500 works off late-Aug sell signals and bearish seasonals while holding trend support; Energy bottom pattern builds**
Fixed Income Strategy	Jason Hunter	FX Technical Strategy: Pro-cyclical trends pause and consolidate, but the technical setup suggests there is more room to run
Fixed Income Strategy	Jay Barry	US Treasury Market Daily: 5-year auction preview
FX Strategy	**Peng Cheng**	**Cross Asset Volatility: Machine Learning Based Trade Recommendations**
Application Software	Mark R Murphy	Confluent: Enabling Real-time Data Flow By Setting Data-in-Motion: Initiate at Neutral, Positive Fundamental View

Source: J.P. Morgan research

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NLP Reports

Source: iStockPhoto

Natural Language Processing (NLP) continues to be an area of rapid advance, which we are applying across the research franchise. This coincides with increased adoption of NLP tools by our clients, driven by improving theoretical approaches and tools from academia and industry (which we discuss later). Note that we have categorized some NLP-related reports under Alt-Data if they had a higher score under that category.

Berowne Hlavaty wrote an update on "State of the Art NLP Tools with Practical Financial Applications such as Thematics, Summarisation, Q&A" including a podcast and DeepFin zoom recording.

Thematic investing is an area uniquely suited to NLP tools and we have been active in this area. Robert Smith wrote on "Thematic Equity Factors From the News Using SmartBuzz 2.0: News-Based 'Sustainable Dividends' Equity Factor Using Only NLP" while Haoshun Liu wrote about 'Measuring the topicality of LDP election candidates' policy proposal which offered some trade ideas for the Japan elections.

We continued our DeepFin Investor Workshop series in the UK where Ayub Hanif hosted NVIDIA covering "Natural Language Modelling with Deep Learning and GPUs".

Peng Cheng continues to explore retail order dynamics, this time turning to Alexandria NLP data in "To YOLO or not to YOLO: A Comparative Analysis of Retail Sentiment and Order Flow".

Sanjay Mookim wrote a series of India Equity Strategy reports subtitled: "The Research Robot" that used Machine reading of company call transcripts combined with sentiment analysis.

Alex Roever used an NLP model to update the Hawk/Dovishness of the FOMC speakers in "Interest Rate Derivatives: The beat goes on"

Joshua Younger applied NLP and ML classifiers to track and quantify market perceptions of public comments made by Federal Reserve officials in "Interest Rate Derivatives: Pay no attention to that convexity behind the curtain".

Elaine Wu wrote a three-part series on China ESG Data that looked into: "Data Privacy Laws, Controversial Events and Greenwashing all using NLP and other ML tools.

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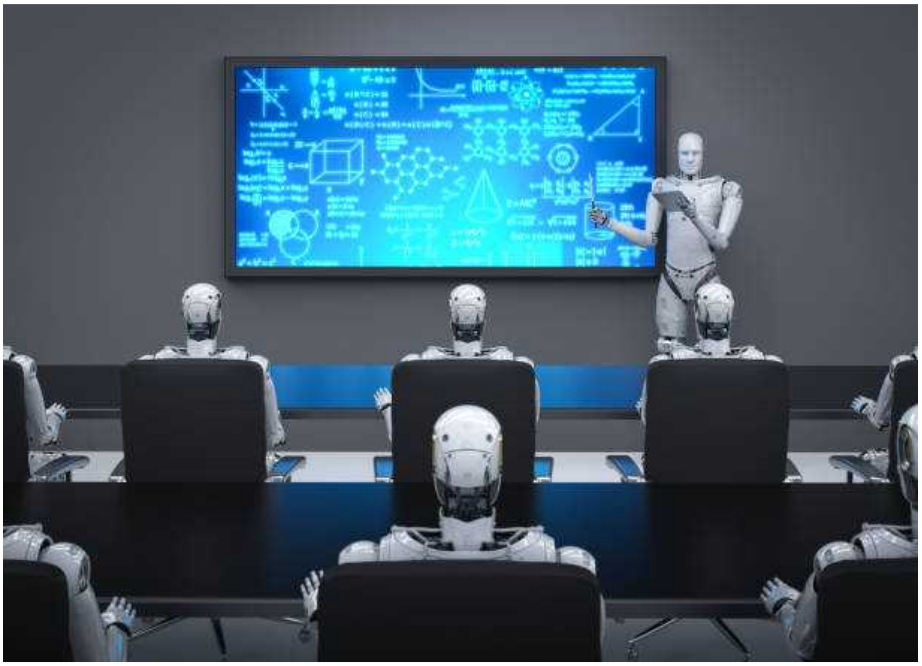
Quantitative & Derivatives Strategy	**Berowne Hlavaty**	**Big Data & AI Strategies: State of the Art NLP Tools with Practical Financial Applications such as Thematics, Summarisation, Q&A**
Quantitative & Derivatives Strategy	**Robert Smith**	**Thematic Equity Factors From the News Using SmartBuzz 2.0: News-Based 'Sustainable Dividends' Equity Factor Using Only NLP**
Equity Research	**Sanjay Mookim**	**India Equity Strategy: The Research Robot: Machine reading company call transcripts**
Equity Research	**Sanjay Mookim**	**India Equity Strategy: The Research Robot: 1QFY22: Management sentiment flat to down sequentially for most sectors**
Quantitative & Derivatives Strategy	**Ayub Hanif**	**Natural Language Modelling with Deep Learning and GPUs: DeepFin Investor Workshop summary with NVIDIA**
Quantitative & Derivatives Strategy	Mixo Das	Asia Quantamental Strategy: Leveraging NLP to assess stock-level impacts of rising costs, supply chain stress and company guidance
ESG	**Elaine Wu**	**China ESG Data Analytics: Part I: Data privacy laws and their sector implications**
ESG	**Elaine Wu**	**China ESG Data Analytics: Part II: Using controversial events to predict share performance**
ESG	**Elaine Wu**	**China ESG Data Analytics: Part III: Identifying greenwashing**
Fixed Income Strategy	**Joshua Younger**	**Interest Rate Derivatives: Pay no attention to that convexity behind the curtain**
Fixed Income Strategy	Joshua Younger	Also sprach the Fed: A natural language processing approach to tracking Fed communications
Fixed Income Strategy	Alex Roever	Interest Rate Derivatives: The beat goes on
Quantitative & Derivatives Strategy	Rajiv Batra	ASEAN Equity Strategy: Supply chain bottlenecks show signs of clearing
Quantitative & Derivatives Strategy	Tony SK Lee	Asia Pacific Equity Derivatives Highlights: NKY dividend outlook, Japan stimulus plays update
Quantitative & Derivatives Strategy	Berowne Hlavaty	Big Data & AI Strategies: SmartBuzz for Trading Thematics in Earnings Call Transcripts and the News
Quantitative & Derivatives Strategy	**Haoshun Liu**	**AI and Big Data Approach to Thematic Investing: Measuring the topicality of LDP election candidates' policy proposal; Trade ideas for the Japan elections**
	Alex Roever	U.S. Fixed Income Markets Weekly
Emerging Markets Research	Fabio Bassi	Global Fixed Income Markets Weekly: Summertime blues
Quantitative & Derivatives Strategy	Mixo Das	Asia Quantamental Strategy: New COVID-19 variant disrupts delicate market balance, but answers to key questions still unknown
Diversified Banks	Natalia Corfield	Bancolombia: It was a lot about lower provisioning expenses; Remain OW the B3 T2 notes
Quantitative & Derivatives Strategy	**Peng Cheng**	**To YOLO or not to YOLO: A Comparative Analysis of Retail Sentiment and Order Flow**

Source: J.P. Morgan research

Conferences, Forums and Tutorials



Source: iStockPhoto

The JPM Quantitative & Derivatives Strategy and other teams have hosted a series of global conferences in different regions to a growing audience of portfolio managers, asset owners and analysts keen to understand the investment implications for their stocks, sectors, portfolios and asset classes. These events are listed below along with details about some of the leading industry conferences.

DeepFin Machine Learning Tutorials in 2021 & 2022

We continued our "DeepFin" series of tutorial sessions focusing on financial modeling using Machine Learning and Deep Learning techniques throughout 2021. These sessions are now run on a virtual platform given COVID-19 lockdown restrictions. Further global events are planned for the remainder of 2021 to ensure you are updated with the core concepts and latest techniques to implement ML/AI and Alt-Data ideas.

Location	Date	Partner	Topic
NY	24/Feb/2021	CausaLens	Hands-on Walkthrough on Causal AI
APAC	7/Apr/2021	CausaLens	Hands-on Walkthrough on Causal AI
EU	8/Jul/2021	CausaLens	CausalAI in Finance: Portfolio Risk and Macro--Economic Forecasting
NY	28/Jul/2021	EagleAlpha	Onboarding Alt-Data
APAC	19/Oct/2021	EagleAlpha	Onboarding Alt-Data
EU	21/Nov/2021	nVidia	Hands-on Walkthrough of NLP with Deep Learning and GPUs
APAC	23/Sep/2021	IBM	Quantum of Sharpe – Introduction to Quantum Computing
APAC	20/Jan/2022	J.P. Morgan	State of the Art NLP Tools with practical examples
EU	24/Feb/2022	RepRisk	Building an ESG Score/Factor

Source: J.P. Morgan.

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J.P.Morgan

J.P. Morgan Conferences

Dates (2021)	Event Name	Region
11-13 Jan	CEEMEA Opportunities Conference	EMEA
12 Jan	J.P. Morgan 19th Annual Tech/Auto Forum during the 2021 International CES	US
12-14 Jan	China Opportunities Forum *Virtual*	APAC
21 Jan	Macro Qu*antitative & Derivatives Conference	EMEA
21-22 Feb	Taiwan CEO-CFO Conference 2021 *Virtual*	APAC
23-25 Feb	Korea Conference 2021 *Virtual*	APAC
15-17 Mar	2021 Industrials Conference	US
15-17 Mar	Pan-European Small/Mid-Cap CEO Conference	EMEA
22-24 Mar	Global ESG Conference	EMEA
29-31 Mar	10th Annual Napa Valley Biotech Forum	US
27-29 Apr	EV Battery Supply Chain Forum 2021 *Virtual*	APAC
24-26 May	J.P. Morgan 49th Annual Global Technology, Media and Communications Conference	US
25-26 May	European Technology, Media and Telecoms Conference	EMEA
31 May - 6 Jun	Global China Summit 2021	APAC
3 Jun	West Coast Biotech Spotlight	US
7-9 Jun	Asia Internet Forum	APAC
8 Jun	Global Leaders Forum	US
11 Jun	2021 Macro Quant Conference	US
14 Jun	European Insurance Conference	EMEA
15-16 Jun	Asia Pacific ESG Forum	APAC
16 Jun	European Healthcare Conference	EMEA
20-21 Jun	European Automotive Conference	EMEA
22-23 Jun	2021 Energy, Power and Renewables Conference	US
23-24 Jun	2021 NextGen Payment & FinTech Forum	US
27-29 Jul	LatAm & CEEMEA SMid Cap Opportunities Conference	US
2-6 Aug	Mexico Opportunities Conference 2021	LatAm
11-12 Aug	2021 Auto Conference	US
16-20 Aug	Brazil Consumer & Healthcare Checkup	LatAm
23-26 Aug	ASEAN TMT & Fintech 1x1 Forum *Virtual*	APAC
30 Aug - 1 Sep	2021 MENA Opportunities Investment Forum	EMEA
5-9 Sep	Asia Pacific CEO-CFO Conference 2021	APAC
20-22 Sep	12th Annual U.S. All Stars Conference	EMEA
21-22 Sep	European Tech Stars Conference 2021	EMEA
11-28 Oct	Global Healthcare Conference, Shanghai Forum	APAC
18-19 Oct	Third Annual J.P. Morgan Media & Communications Industry Panel Forum	US
7-11 Nov	Global Energy Conference	EMEA
9-18 Nov	2021 Global TMT Conference in Asia & 1st Disruptive Tech Conference in India	APAC
21-22 Nov	Best of British Seminar	EMEA
29 Nov - 1 Dec	Brazil Opportunities Conference 2021	LatAm
30 Nov	Crypto Economy Forum: Today's Ecosystem and Tomorrow's Marketplace	US
30 Nov	US Fixed Income Markets 2022 Outlook Conference	US
30 Nov - 2 Dec	Asia ESG Corporate Forum	APAC
6-8 Dec	South Africa Opportunities Conference 2021	EMEA
12-13 Dec	India Emerging Opportunities Forum 2021 *Virtual*	APAC

Source: J.P. Morgan.

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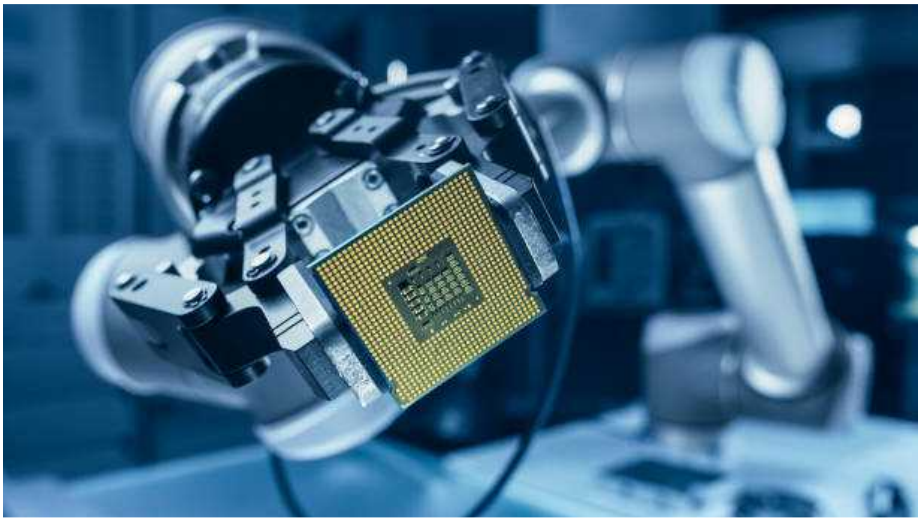
Major Industry Conferences

2-9 Feb 2021	Association of Artificial Intelligence Conference (AAAI21)
22-26 Feb 2021	Global Artificial Intelligence Conference
2-4 March 2021	AI for Business Summit
8 Mar 2021	Global Women in Data Science (WiDS)
27-28 April 2021	Red hat Summit
4-7 May 2021	ICLR Ethiopia
8-10 June 2021	Open Data Science Conference
10-15 Jul 2021	North American Chapter of the Association for Computational Linguistics (NAACL 2021)
2-4 Aug 2021	Association for Computational Linguistics (ACL 2021)
14-18 August 2021	ACM SIGKDD Conference on Knowledge Discovery and Data Mining
14-17 Aug 2021	Knowledge Discovery in Databases (KDD)
2-3 Sept 2021	Intelligent Systems Conference
16-18 Oct 2021	International Conference on AI in Finance (ICAIF 2021)
11-13 Nov 2021	Supercomputing 2021 (SC21)
22-23 Sept 2021	AI & Big Data Expo
27 Nov-5 Dec 2021	NeurIPS 2021

Source: J.P. Morgan.

Industry Developments and News



Source: iStockPhoto

Beyond J.P. Morgan Global Research, we have curated key developments from academic and industry research, highlighting progress and major discoveries introduced over the second half of the year, especially within the AI, NLP, software, wetware and hardware systems as well as in quantum mechanics.

A tectonic shift is underway from the use of traditional CPU chips to purpose-built GPU, TPU, IPU, chips as well as analogue RPU chips, soon to be built with microscopic precision down to 1nm. Quantum computing has advanced, with a refined focus on effective quantum volume rather than just counting qubits, and new innovations continue in photonic quantum hardware. State of the art advances have been achieved in GPT-3 and now Wu Dao 2.0 & M6 with 10Tn *efficiently* trainable parameters for NLP tasks. Here we share some identified noteworthy contributions from Facebook, Neuralink, Google, Amazon, Microsoft, IBM, DeepMind, OpenAI, Intel, nVidia, and many other prominent organizations and academics.

CMU and JPMorgan Chase & Co Open an AI Maker Space
JPMorgan Chase & Co. opened an AI Maker Space at Carnegie Mellon University with a robot-assisted ribbon cutting and hackathon hosted by the AI Research team.

NLP tools used to review AI Research

The industry developments highlighted below were identified from various blogs and news sites across the internet. We have used NLP Summarisation tools (documented in our SotA paper) to draft the summaries before editing the majority by hand to help improve the readability and ensure the key insights for each development were captured.

Multi-Modal Machine Learning

Source: iStockPhoto, J.P. Morgan

Alibaba create M6, a 10Tn Parameter Model using 1% of GPT-3's Energy Cost

Alibaba DAMO Academy (the R&D branch of Alibaba) announced they had built M6, a large multimodal, multitasking language model with 1 trillion parameters already 5x GPT-3's size, which serves as the standard to measure the rate of progress for large AI models.

Wu Dao 2.0 is currently the Largest Transformer Model

Wu Dao 2.0 is a 1.75 trillion parameter deep learning model. It exhibits several impressive capabilities such as its ability to multitask in language and image domains.

Meta AI create OMNIVORE to interpret all types of visual media

Meta AI researchers set out to train OMNIVORE a universal model that could operate on three major *visual* modalities: images, videos, and single view 3D (depth). They leveraged the powerful self-attention mechanism of transformer architectures, which can capably handle variable-sized inputs.

Image generation gains a big improvement with VQGAN

Transformers continue to show state-of-the-art results on a wide variety of tasks. In contrast to CNNs, transformers contain no bias that local interactions make them expressive, but also computationally feasible for long sequences, such as high-resolution images. The authors present the first results on semantically-guided synthesis of megapixel images with transformers.

Natural Language Processing (NLP), Understanding (NLU), Generation (NLG) and Summarisation

Source: iStockPhoto

Meta-learning for GNNs

Megatron-Turing Natural Language Generation model has 105 layers, 530 billion parameters, and operates on chunky supercomputer hardware like Selene.

FLAN improves NLP models with zero-shot training, fine-tuning and prompting

FLAN stands for Finetuned LAnguage Net, and describes a method for improving zero-shot learning for NLP models by using natural language instructions (instruction tuning) using: pretraining, finetuning and prompting.

MIT presents new approach for sequence-to-sequence learning with latent neural grammars

This MIT paper proposes an alternative, hierarchical approach to seq2seq learning with quasi-synchronous grammars, developing a neural parameterization of the grammar which enables parameter sharing over the combinatorial space of rules without requiring manual feature engineering.

brat is a rapid annotation tool

brat is a web-based tool for text annotation; that is, for adding notes to existing text documents. Structured annotation, where the notes are not freeform text but have a fixed form, can be automatically processed and interpreted by a computer.

OpenAI Codex

OpenAI Codex is a descendant of GPT-3; its training data contains both natural language and billions of lines of source code from publicly available sources, including code in public GitHub. It has a memory of 14KB for code creation and is proficient in over a dozen languages including Python, JavaScript, Go, Perl, PHP, Ruby, Swift, TypeScript, and even the Linux Shell.

New Service combines access to OpenAI GPT-3 with Azure's cloud capabilities
Microsoft announced Azure OpenAI Service, which allows access to OpenAI's API through their platform and was initially by invitation only.

OpenAI's API Now Available with No Waitlist
OpenAI is committed to the safe deployment of AI making improvements to GPT-3. The recent inclusion of the "Instruct Series" helps make the models adhere better to human instructions, giving specialized endpoints for more truthful question-answering, and a content filter to help developers mitigate abuse.

Microsoft's DeBERTaV3 uses ELECTRA-style pretraining with gradient-disentangled embedding sharing to boost DeBERTa performance at NLU
Microsoft released DeBERTaV3, an updated version that leverages ELECTRA-style pretraining with gradient-disentangled embedding sharing to achieve better pretraining efficiency and a significant jump in model performance.

NLP to identify "quotes" in news articles
The Guardian's data scientists have been working with other newsrooms on a global project to think about AI and journalism. They have built an NLP pipeline with spaCy and Prodigy to teach the machine what a quote is.

AI model to solve maths problems stated in English
State-of-the-Art language models can match human performance on many tasks, but they still struggle to robustly perform multi-step mathematical reasoning. To diagnose the failures of current models and support research a team from OpenAI introduce GSM8K, a dataset of 8.5K high quality linguistically diverse grade school math word problems.

A neural network solves and generates mathematics problems by program synthesis: calculus, differential equations, linear algebra, and more
Transformers demonstrate that a neural network pre-trained on text and fine-tuned on code solves Mathematics problems by program synthesis. They turn questions into programming tasks, automatically generate programs, and then execute them, perfectly solving university-level problems from MIT's large Mathematics courses.

Aspect-controllable opinion summarization
Recent work on Aspect-Controllable Opinion summarization by ACL Anthology produces general summaries based on a set of input reviews and the popularity of opinions expressed in them. In this paper, the authors propose an approach that allows the generation of customized summaries based on aspect queries.

DeepMind released Gopher
DeepMind developed Gopher a large language AI with 280 billion parameters that has greatly surpassed previous state-of-the-art. Like GPT-3, is an autoregressive transformer-based dense model trained to predict the next word given a text history.

Topic Modelling simplified with BerTopic
BERtopic is a topic Modeling technique that leverages transformers and c-TF-IDF to create dense clusters allowing for easily interpretable topics whilst keeping important words in the topic descriptions. It is very straightforward and easy to operate, from the model creation to the various functions.

Chat Bots

Source: iStockPhoto

The Future of Conversational AI. Predictions from the experts

The Conversational AI space has made great strides in the underlying technologies, use cases, and adoption. We are moving past the days of basic question and answer experiences and simple decision trees to incorporate sophisticated Natural Language Understanding (NLU).

The Current Conversational AI & Chatbot Landscape

These Conversational AI tools and frameworks can be divided into four categories, roughly. Category 1 The open source, Category 2 large-scale commercial offerings, Category 3 independent, alternatives for Conversational AI, and Category 4 NLP & NLU tools.

GPT-3 enhanced with Instructions

InstructGPT was trained by 40 OpenAI specialists to output more appropriate responses to NLG tasks, helping it to avoid earlier concerns about the use of inappropriate language, racism and other human bias learned from scanning the web.

Machine Learning (ML) Techniques & Tools

Source: iStockPhoto

Representing Part-Whole Hierarchies in a Neural Network

The algorithms used my ML/AI models continue to advance. From early fully connected DNNs to CNNs, RNNs, LSTMs, Capsules and Transformer networks to GLOM, which Geoffrey Hinton proposes should help AI's better understand visual scenes by deconstructing objects using a parse tree.

Knowledge Distillation – Teacher Student Networks

As NN's get larger single system processing becomes impossible, making Knowledge Distillation to smaller networks necessary.

Czekanowski Index-Based Similarity as Alternative Correlation Measure in N-Asset Portfolio Analysis

Czekanowski Index-Based Similarity is an alternative measure of correlations borrowed from quantitative biology that can be applied to portfolio risk measurement.

Non-Deep Neural Networks

Depth is the hallmark of deep neural networks. But more depth means more sequential computation and higher latency. This begs the question — is it possible to build high-performing "non-deep" neural networks? The authors used parallel substructures with just 12 layers instead of deep stacking of layers to achieve SotA scores in various tasks.

Transformers4Rec: A flexible library for recommendations

The nVidia team released Transformers4Rec, an open-source library for building state-of-the-art sequential and session-based recommendation models with PyTorch and Transformer architectures. The Merlin workflow helps the entire ML pipeline.

Google proposes ARDMs: Efficient autoregressive models that learn to generate in any order

Autoregressive Diffusion Models (ARDMs) are a model class encompassing and generalizing order-agnostic autoregressive models and discrete diffusion models that do not require causal masking of model representations and can be trained using an efficient objective that scales favourably to highly-dimensional data.

Algorithms for decision making

The Algorithms for Decision Making book provides a broad introduction to algorithms for decision making under uncertainty. It covers a wide variety of topics to decision making, introducing the underlying mathematical problem formulations and the algorithms for solving them.

River package for ML pipeline on streaming data

River is a Python library for online machine learning. It is the result of a merger between creme and scikit-multiflow.

MATE, A meta-learning approach for training explainable GNNs

A Meta-Learning Approach for Training Explainable Graph Neural Networks. Existing explainers work by finding global/local subgraphs to explain a prediction, but they are applied after a GNN has already been trained. MATE is jointly trained on the original task and the explanation task simultaneously.

Farewell to the bias-variance tradeoff? An overview of the theory of overparameterized machine learning

Overparameterized models are excessively complex with respect to the size of the training dataset, which results in them perfectly fitting (i.e., interpolating) training data, which is usually noisy. This paper provides a succinct overview of the emerging theory of overparameterized ML models.

DNNs solved

This paper shows that deep learning (DL) representations of data produced by generative adversarial nets (GANs) are random vectors which fall within the class of so-called concentrated random vectors that behave as Gaussian Mixtures. This suggests that DL representations of GAN-data can be fully described by their first two statistical moments for a wide range of standard classifiers.

MAPIE reintroduces uncertainty in AI Models

Quantmetry present MAPIE, an open-source package, developed at Quantlab R&D project, re-introducing the notion of uncertainty in AI, backed by a model-agnostic and user-friendly implementation.

labml.ai annotated PyTorch paper implementations

DNN Model implementations are documented with explanations, and the labml.ai website renders these as side-by-side formatted notes.

UMAP dimension reduction algo

UMAP is a general-purpose manifold learning and dimension reduction algorithm. It is designed to be compatible with scikit-learn, making use of the same API and able to be added to sklearn pipelines.

Intel's prune once for all compression method achieves SOTA compression-to-accuracy results on BERT

To address this issue, some recent studies have introduced compression algorithms designed to increase the implementation efficiency of large transformer-based models. An Intel Labs research team has proposed Prune Once for All (Prune OFA), a training method that leverages weight pruning and model distillation to produce pretrained transformer-based language models with high sparsity ratios.

KalmanNet

KalmanNet overcomes non-linearities and model mismatch, outperforming classic filtering methods operating with both mismatched and accurate domain knowledge.

Text to image with gaugan2

GauGAN2 creates photorealistic images from segmentation maps, which are sketches that depict the layout of a scene. Artists can use text, a paintbrush and paint bucket tools, or both methods to design their own landscapes.

AI solves antibacterial problem

Using a machine-learning algorithm, MIT researchers have identified a powerful new antibiotic compound. In laboratory tests, the drug killed many of the world's most problematic disease-causing bacteria, including some strains that are resistant to all known antibiotics.

GFlowNet Foundations

GFlowNets amortize the work typically done by computationally expensive MCMC methods in a single but trained generative pass. They can be used to estimate joint probability distributions and the corresponding marginal distributions where some variables are unspecified and, of particular interest, can represent distributions over composite objects like sets and graphs.

All Bark and No Bite: Rogue Dimensions in Transformer Language Models Obscure Representational Quality

Standard representational similarity measures such as cosine similarity and Euclidean distance have been successfully used in static word embedding models to understand how words cluster in semantic space. Recently, these measures have been applied to embeddings from models such as BERT and GPT-2. The authors argue that accounting for rogue dimensions is essential for any similarity-based analysis of contextual language models.

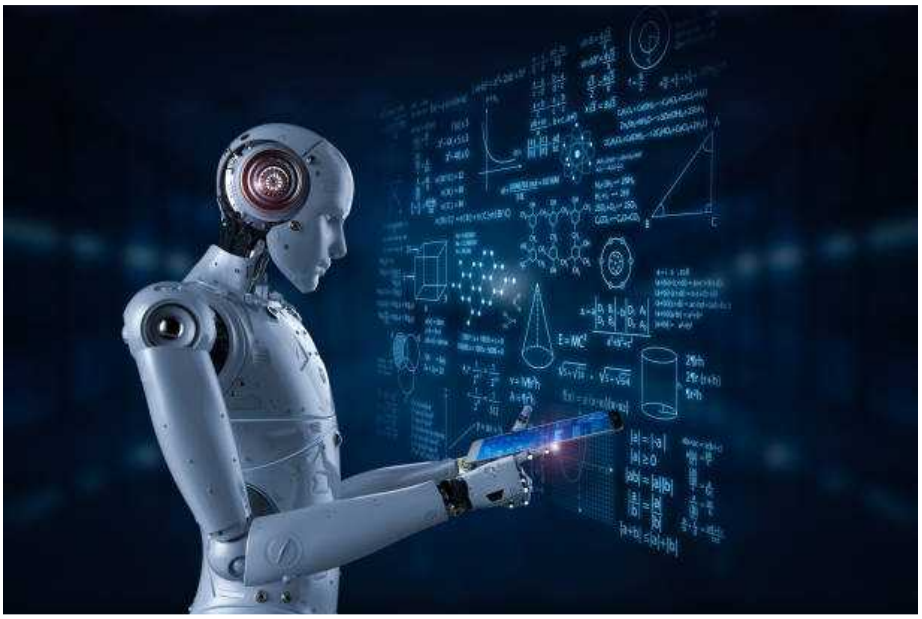
EfficientNetv2 for memory and training time efficient models

EfficientNetV2 trains much faster than state-of-the-art models while being up to 6.8x smaller. The models were searched from the search space enriched with new ops such as Fused-MBConv.

GNNs get the GRAND treatment

Graph Neural Diffusion (GRAND) that approaches deep learning on graphs as a continuous diffusion process and treats Graph Neural Networks (GNNs) as discretisations of an underlying PDE. In this model, the layer structure and topology correspond to the discretisation choices of temporal and spatial operators. The new class of GNNs are claimed to address the common plights of graph learning models such as depth, over-smoothing, and bottlenecks.

Automated Machine Learning, GANs and RL



Source: iStockPhoto

FLAML – autoML

FLAML is a lightweight Python library that finds accurate machine learning models automatically, efficiently and economically. It frees users from selecting learners and hyperparameters for each learner.

FEDOT for autoML

FEDOT is an open-source framework for automated Modeling and machine learning (AutoML). It can build custom modeling pipelines for different real-world processes in an automated way using evolutionary approach.

IBM leverages reinforcement learning to achieve SOTA performance on text and knowledge base generation

In the new paper ReGen: Reinforcement Learning for Text and Base Generation Using Pretrained Language Models, an IBM research team proposes ReGen, a method for bidirectional reinforcement learning (RL) to push the performance of text-to-graph (T2G) and graph-to-text (G2T) models.

Low-code and no-code systems gain traction

Systems like Pega allows teams to utilize pre-built templates and quick-start tools to help define key app components in one inclusive authoring environment. ServiceNow Low Code provides secure and quality code that protects and can be integrated with firm's IT Service Management processes and controls. Unqork is a highly scalable and functionally capable platform that addresses simple workflows.

Predicting Parameters of DNN's using AI

Research into the design of deep neural nets is also using AI, with HyperNetworks able to pre-program the model parameters of acceptably performant models in one pass, cutting training time dramatically.

TimeSeries

Source: iStockPhoto

Application of variational mode decomposition and deep learning in time-series forecasting

The experimental results show that compared with the BP, LSTM and EEMD - LSTM model, the new Variational Mode Decomposition model completely weakens the non-stationary time sequence, minimize the prediction error, reached the highest prediction accuracy for difficult non-stationary time series based problems.

GIOTTO for time series forecasting

Giotto-Time is an open-source Python library to perform time-series forecasting in machine learning. It is built on top of Sci-Learn with a few modifications and wrappings to do end-to-end time-series analysis in a single go.

Time series analysis with Merlion from SalesForce

TuringGLM is a new Julia package for Bayesian GLM models and is based on the Turing package on the backend and inspired by the R's brms and Python's bambi packages.

Orbit for Bayesian time series modeling and inference

Orbit is a Python package for time series Bayesian inference and modelling. It provides a familiar and intuitive-fit-predict interface for working with time series, while utilizing probabilistic programing languages under the hood.

Data & Labels

Source: Pexels

What happens to a NN that uses self-supervised-learning

Labeled data is expensive. To combat this, a lot of research is being targeted towards self-, zero-shot-, and un-supervised-learning techniques. There are some advantages and disadvantages of letting the network generate its own labels. Contrastive pairs have also been explored to understand how SSL works by a team at Facebook AIR.

QuantCube offer real-time economic indicators

QuantCube launches four new real-time economic indicators using intelligence gathered from global satellite data from the European Space Agency that focus on changes to the environment, including urban growth, pollution levels, water supplies and agricultural output.

Quantum Computing

Source: iStockPhoto

New quantum technology from a team in China
Researchers from the University of Science and Technology of China (USTC) claim to have built the world's fastest quantum computers, which appear to crack problems that are currently not feasible for "classical" computers. They claim Zuchongzhi 2.1 is more powerful than Google's Sycamore while the smaller Jiuzhang 2 is based on photonic technology that operates at room temperature.

Breakthrough proof clears path for quantum AI
A novel proof that certain quantum networks can be guaranteed to be trained clears the way for artificial intelligence. Convolutional Neural Networks running on quantum computers have significant buzz for their potential to analyze quantum data better than classical computers can.

D-Wave announces new hardware, compiler, and quantum computing plans
D-Wave is developing its own gate-based hardware, which it will offer in parallel with the quantum annealer.

Researchers reach quantum networking milestone in real-world environment
Department of Energy's Oak Ridge National Laboratory, Stanford University and Purdue University developed and demonstrated a novel, fully functional quantum local area network, or QLAN, to enable real-time adjustments to information shared with geographically isolated systems at ORNL using entangled photons passing through optical fiber.

Physicists take a key step in correcting quantum computer errors
A team at FAIR has demonstrated a way to detect errors in the setting of a qubit that's guaranteed not to make matters worse. Such 'fault tolerant qubits' are a necessary step towards the grand goal of maintaining finicky qubits so that they can be manipulated indefinitely.

Multiplexing quantum communications network
A team led by the University of Bristol in the UK confirmed a method of securing online communication that relies on multiplexing of entangled quantum photons for interception-proof communication.

Room temp qubits
Australian/German startup Quantum 4 has developed a quantum microprocessor that does not need cryogenic cooling and propose a 50 qubit model the size of a graphics card. The technique is based on nitrogen-vacancy 'holes' in a diamond lattice.

Otherworldly 'time crystal' made inside Google quantum computer could change physics forever
Researchers working in partnership with Google may have just used the tech giant's quantum computer to create a completely new phase of matter, a time crystal. These bizarre time crystals remain stable, resisting any dissolution into randomness, despite existing in a constant state of flux.

China claims to have built the most powerful quantum computer yet
Chinese scientists claim to have built the most powerful quantum computer yet. The 66 qubit machine used 56 qubits to solve a problem in just 70 minutes which would have taken a supercomputer 8 years to achieve.

Critical advance enables the control of millions of qubits in quantum chips
Researchers at the University of New South Wales (Australia) have discovered a new technique that will apparently enable them to control millions of spin qubits. This was a major roadblock for producing quantum computers, which can perform to their peak capacity.

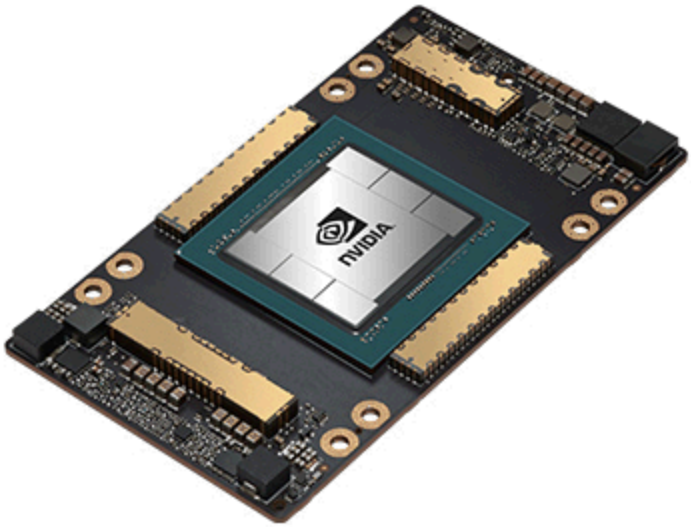
New quantum computer from IBM
The 'Eagle' is IBM's first quantum processor developed and deployed to contain more than 100 operational and connected qubits. At 127bits, the Eagle is the most powerful quantum processor in the world, surpassing China's 113-qubit Jiuzhang 2.0 and Google's 72-qubit Bristle.

Quantum computing just exceeded 99% accuracy
Three separate teams around the world have passed the 99 percent accuracy threshold for silicon-based quantum computing, placing error-free quantum operations within tantalizing grasp.

Qiskit authors release free, hands-on quantum machine learning course
Quantum Machine Learning (QML) now has a self-paced online course designed to help curious learners build a deeper understanding of QML.

CPU, GPU, TPU, IPU, RPU & Other Hardware Developments

Figure 2: The nVidia A100 GPU



Source: nVidia (with permission).

IBM release power10 CPU

Power10 is both the most secure and reliable server in its class Extend enterprise-grade reliability across hybrid cloud. Power10 can detect, isolate, and recover from soft errors automatically in the hardware without taking an outage or relying on an OS to manage the faults.

Google Pixel 6's Tensor chip for Android 12 phones

Google designed its own processor for the first time. The goal is to create a Pixel phone loaded with AI smarts and battery life long enough to power through a day. The new phones are powered by a custom-built System on a Chip (SoC) built for mobile that enables Google to bring out the most innovative AI and machine learning (ML) to Pixel users with TensorFlow support.

Telum is a new AI processor developed with technology from IBM Research

Telum is IBM's first commercial processor to contain on-chip acceleration for AI inferencing.

Samsung has its own AI-designed chip and Vertical design (with IBM)

Samsung is using AI features in new software to design its Exynos chips, which are used in smartphones, as well as other gadgets. In collaboration with IBM, Samsung are also working on new vertical transistor architecture that has the potential to reduce energy usage by 85%.

Chip to cloud security with Pluton-powered Windows 11 PCs

The Microsoft Pluton is a security processor, pioneered in Xbox and Azure Sphere, designed to store sensitive data, like encryption keys securely within the Pluton hardware, which is integrated into the die of a device's CPU and is therefore more difficult for attackers to access, even if they have physical possession of a device.

Scientists create single-atom devices to supercharge computers
Researchers from the National Institute of Standards and Technology (NIST) and the University of Maryland were able to create single-atom transistors for only the second time ever. They also achieved an unprecedented quantum mechanics feat, allowing for the future development of computers.

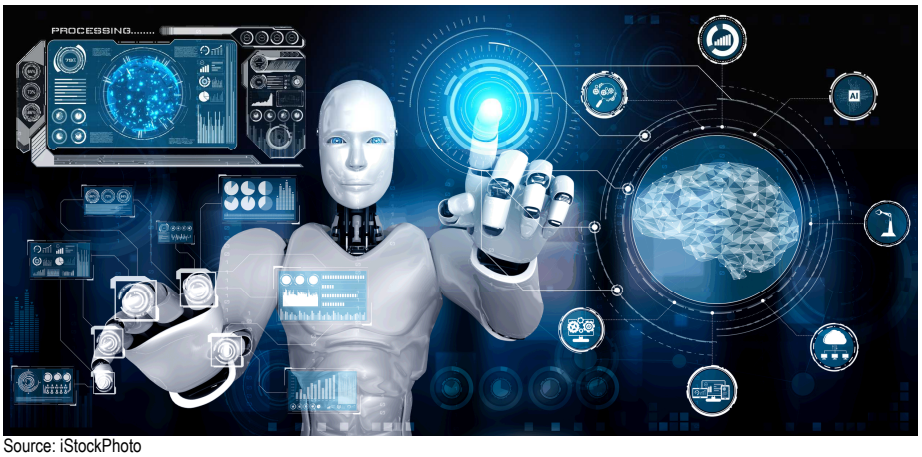
Tesla launch D1 Chip
At the Tesla AI Day, director Ganesh Venkataramanan unveiled Tesla's computer chip Dojo which is able to process vast amounts of camera imaging data four times faster than other computing systems. The chips can be grouped in Tiles that combine to build their super computer.

Tesla unveils its new supercomputer to train self-driving AI
Tesla's new supercomputer is the fifth-most powerful globally and is being used to train the neural nets powering Tesla's Autopilot and upcoming self-driving AI.

Japan's ARM-based 'Fugaku' system now the world's fastest supercomputer
Fujitsu and the Riken research institute ended up packing 152,064 A64FX chips into what would become the Fugaku system, now the world's fastest supercomputer.

Meta has a Next-Gen AI Supercomputer
The AI Research Super Cluster (RSC) is among the world's fastest AI supercomputers now that could be the fastest in the world once fully built out in mid-2022. RSC will accelerate AI research and help build the metaverse.

Robotics



Source: iStockPhoto

Sophia the Social Robot

Sophia the robot was designed specifically to interact with humans. Social robots have many potential applications, including some we're already seeing in the real world, such as helping the sick, elderly, or those with learning disabilities.

Tesla Bot: A definitely real humanoid robot launched at Tesla AI day

At the Tesla AI Day, Elon Musk described Tesla as a company with 'deep AI activity in hardware on the inference level and on the training level' that can be used down the line for applications beyond self-driving cars.

Life-like robots

Ameca is a not-quite-robot, not-quite-human gray plastic and metal humanoid. It has 17 individual motors inside its head controlling its movements and expressions which are surprisingly vivid and emotive.

Now you can rent a robot worker for less than a human

It's unclear what impact the use of robots will have on the supply of jobs in the long term, but they are filling an important short-term need, such as simple tasks like delivering supplies in hospitals or repetitive tasks in factories, as the pandemic has led to labor shortages in numerous industries.

Wetware – Human Computer Interfaces

Source: iStockPhoto

Many popular AI models such as neural networks have been inspired by the architecture of the human brain. Attentional mechanisms have become a recent source of inspiration in deep learning models such as convolutional neural networks (CNNs) or deep generative models. For this reason, we continue to review the latest developments in neuroscience and the interface with hardware, known as 'wetware'.

The biggest brain maps ever are pushing the frontiers of neuroscience

Brain mapping of the 'connectome' is an unenviable task with a staggering scale and complexity. A collaborative effort between Harvard and Google providing the highest resolution image of the brain to date. The gallery is spectacular.

Pager (Neuralink Monkey) & Cyborg brains in a petri dish learn to play Pong

Pager, a nine year old Macaque, plays MindPong with his Neuralink. While separately hundreds of thousands of human brain cells in a dish ("DishBrain") have also learned to play Pong faster than AI according to a team at Cortical Labs.

Scientists discover how to 'upload knowledge to your brain'

The study, published in the journal Frontiers in Human Neuroscience, found that subjects who received brain stimulation via electrode-embedded head caps improved their piloting abilities and learnt the task 33 per cent better than a placebo group.

Human neurons exceptionally energy efficient compared to 9 other mammals

Researchers have found that human neurons have a much smaller number of ion channels than expected and compared to the neurons of other mammals. This may have helped the human brain evolve to operate more efficiently.

Novel biosensor set to revolutionize brain-controlled robotics

A team of researchers from the University of Technology, Sydney (UTS) have developed a novel carbon-based biosensor that adheres to the skin of the face and head in order to detect electrical signals being sent by the brain.

InWith promises world's first soft smart contact lens

InWith Corporation says it's developed the world's first soft electronic contact lens. A smart lens could deliver real-time information directly to your eyes.

Software, Platform & Tool Developments

Source: iStockPhoto

nVidia announce substantial updates to Hardware and Software tools for AI
nVidia has introduced 65 new and updated software development kits — including libraries, code samples and guides — that bring improved features and capabilities to data scientists, researchers, students and developers who are pushing the frontiers of a broad range of computing challenges. Some of the improvements affect the popular tools like ReOpt, cuNumeric, cuNumeric, CUDA-X, RAPIDS and many more.

Prefect is a new competitor to AirFlow
Prefect Core is a new kind of workflow management system that makes it easy to take your data pipelines and add semantics like retries, logging, dynamic mapping, caching, failure notifications, and more.

Dynamic type checking of Python functions, the Dropbox experience
Dynamic typing in Python made code needlessly hard to understand and started to seriously impact productivity at DropBox. To mitigate this, they have been gradually migrating their code to static type checking using mypy, likely the most popular standalone type checker for Python.

PDF Table Processing with Python
Tabula is a simple Python library which reads tables in PDFs and converts them into Pandas Dataframes. It is very important to recognize a page break as a break in a table and users need caution as Tabula may recognize a table that spans two pages as two separate tables.

Scikit-Learn reaches 1.0 in September 2021
By releasing version 1.0 of scikit-learn it signals to the large user base that the package is considered stable. This release includes some new key features as well as many improvements and bug fixes.

Neural Databases

Facebook developed a new approach to store data called neural databases, which enables machines to search unstructured data – which might range from vast collections of text to recordings of songs – similar to how traditional systems can search a typical structured database.

Quant Investing Package: QLIB

Qlib is an AI-oriented quantitative investment platform, which aims to realize the potential, empower the researcher, and create the value of AI technologies in quantitative investment. It contains the full ML pipeline of data processing, model training, back-testing; and covers the entire chain of quantitative investment processes.

nVidia updates for TensorRT offer 6x faster model performance

Torch-TensorRT ingests Torch models and optimises them for GPUs. It provides a simple API that gives up to 6x performance speedup with just one line of code. This gives users the potential for T5 and GPT-2 models to run inference in real-time. TensorRT has had long running support for TensorFlow models.

Nvidia unveils Omniverse free version for millions of creators and artists

Omniverse, billed by Nvidia as a metaverse for engineers, will now have a free version available for a much larger community of creators and artists.

Is simulation the answer?

Climate models are multidecade simulations that model the physics, chemistry and biology of the atmosphere, waters, ice, land and human activities. Climate simulations are configured today at 10- to 100-kilometer resolutions. But greater resolution is needed to model changes in the global water cycle. nVidia is using their expertise, tools and technology to help simulate climate change impacts at higher resolutions.

HuggingFace launch Infinity

HuggingFace, an open source ML start-up, has built a collection of transformer models that are being built, shared, and deployed. Their new Infinity subscription service achieves ~1ms latency on Transformer model inference that can be deployed on your own infrastructure, public cloud or HuggingFace servers.

Ethical Issues of AI

Source: iStockPhoto

A growing concern within the AI Community is centered on ethics, and the lack of rules being embedded in autonomous systems. Continuing from this reports previous editions where we noted people calling for a new rules for AI, updated for the times, such as those advanced by the Organization for Economic Cooperation and Development.

DeepMind have released a study of ethical and social risks associated with large language models.

Ethical AI. How an algorithm blocked kidney transplants to black patients

Black people in the US suffer more from chronic diseases and receive inferior health care relative to white people. Doctors often make life-changing decisions about patient care based on algorithms that interpret test results or weight risks, like whether to perform a particular procedure.

Crypto Currencies

Source: iStockPhoto

NFT mania gets (artificial) intelligent

If you are wondering what all the fuss about the 'metaverse' is, it promises to be more than just a virtual world for geeks to hang-out in. The integration of 'non-fungible tokens' (NFTs) for virtual 'assets' such as virtual- real-estate, infrastructure and art with provable ownership and transactions recorded in a blockchain makes virtual (and real) wealth accumulation possible. Some argue this is another 'greater fool' bubble much like the 'tulip mania' of the 1600s.

Noah's Ark, the world's first Intelligent Metaverse, aims to preserve and evolve the culture and collective intelligence of the human species. The Revenants collection has a distinguished provenance for being the first-ever intelligent collectibles, a pivotal moment in the early history of NFTs. The Train-to-Earn model allows iNFT owners to Earn the more that people interact with their iNFT on Noah's Ark.

Digital bond linked to traditional bond issued by SIX

SIX issues first tokenized bond in the world on a regulated and fully integrated digital exchange. The digital part (Part A) of the bond will be listed and traded on SDX Trading Ltd and centrally held by SIX Digital Exchange Ltd.

Central Bank of Bahrain and J.P. Morgan trade the JPM Coin digital currency

The Central Bank of Bahrain has teamed up with J.P. Morgan's blockchain and crypto unit Onyx to test the JPM Coin digital currency. The system serves as a payment rail and deposit ledger account, enabling participating entities to transfer US dollars.

Recommended Reading

- What Machine Learning Will Mean for Asset Managers
- Max Kuhn's Applied Predictive Modeling book.
- Andrew Ng's AI Transformation Playbook
- SOTA
- DeepLearning.ai
- Fast.ai
- Open.ai
- IBM Research Blog (Extensive especially for Quantum)
- Google AI Blog
- Microsoft AI Research Blog (Extensive!)
- Uber AI Research
- Meta / FaceBook AI Research (Improving)
- Baidu Research
- Medium.com (Getting noisy with popularity)
- Towards Data Science
- blog.acolyer.org
- Twiml AI
- neurohive.io
- Ma & Musk on AI
- The Sequence
- JP Morgan Markets

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DataQuery

DataQuery now allows users to view market movers in real-time. As part of our continuing strategy to evolve DataQuery into a unified and best-in-class Pre-Trade Analytics hub, we have launched DataQuery Market Monitor, which provides a real-time view of market data. We also released DataQuery Market Impacting Events, to allow users to overlay and analyze the impact of macroeconomic indicators, as well as geopolitical events, on queries and charts.

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*Please note that the percentages might not add to 100% because of rounding.
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