Expert Panel Discussion

REINVENTING DRUG DEVELOPMENT IN THE AGE OF AI

PRESCOUTER

John Snow LABS

Agenda

PreScouter Introduction (2-3 minutes)

Introduction on LLMs in Pharma/Biotech (10 minutes)

Speaker introductions (2-3 minutes)

Panel Discussion (35-40 minutes)

Rapid Fire Audience Questions (5 minutes)

Close-out (2-3 minutes)

PreScouter Intro

REINVENTING DRUG DEVELOPMENT IN THE AGE OF AI

Jeremy Schmerer - Director of Life Science @ PreScouter

PRESCOUTER

WHO IS PRESCOUTER?

Mission: To make innovation happen.

RESEARCH CONSULTING

- Extension of team
- Less time on tactical
- Actionable insights
- Research efficiency

ENHANCE TECHNICAL AND MARKET PERSPECTIVE

- International
- Adjacent Industries
- Fill Knowledge Gaps
- Benchmarking

MITIGATE RISK

- Early Opportunity Capture
- Market Analysis
- Avoid Missing Trends
- Limit Unproductive Efforts

Introduction LLMs

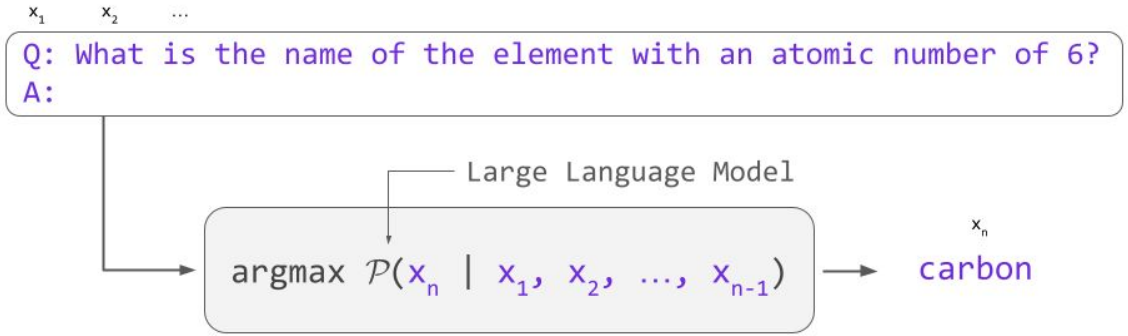
REINVENTING DRUG DEVELOPMENT IN THE AGE OF AI

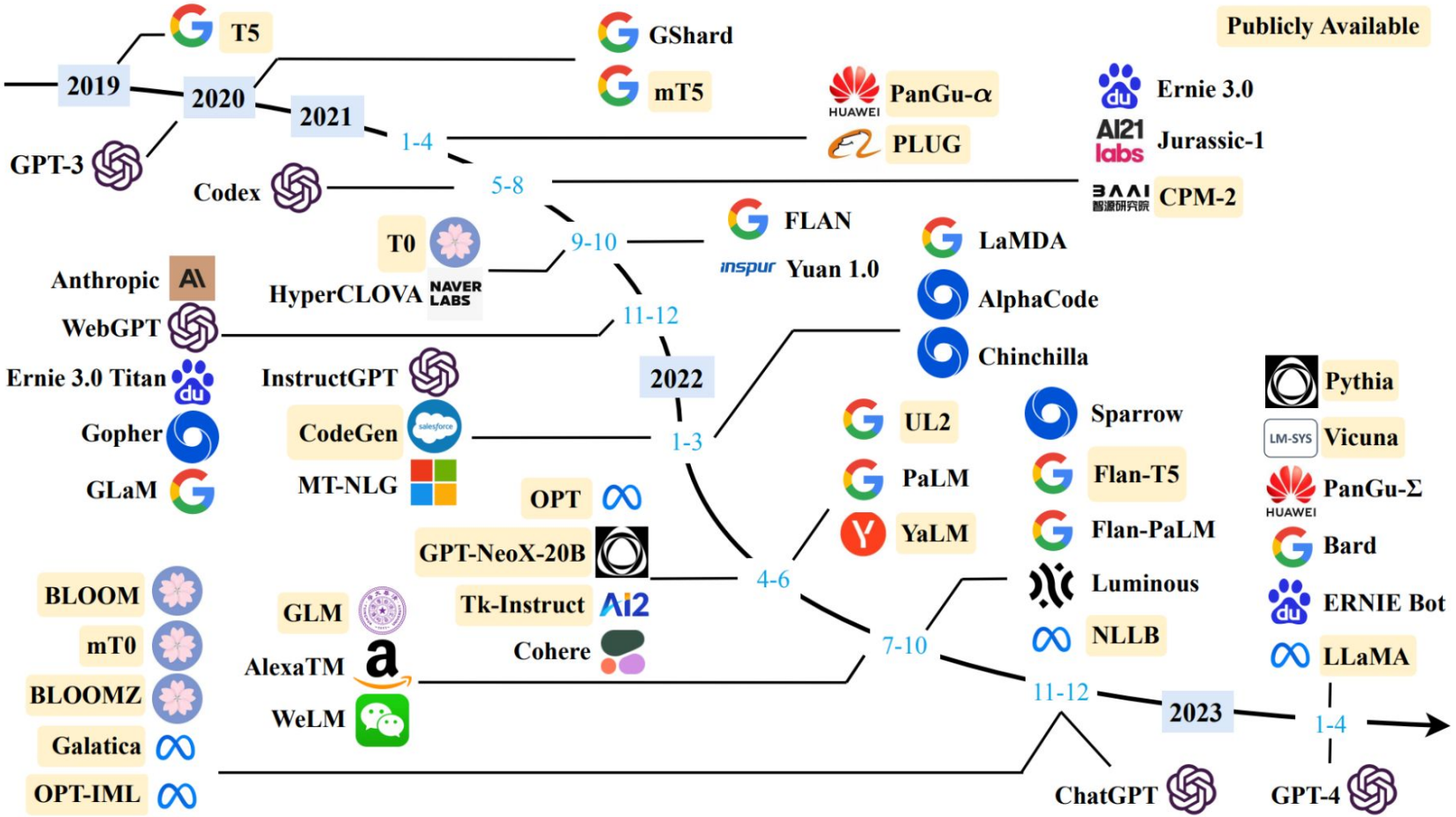
Veysel Kocaman - Head of Data Science @ JSL

PRESCOUTER John Snow LABS

What is an LLM ?

A large language model (LLM) is a language model consisting of a **neural network with many parameters** (typically billions of weights or more), trained on **large quantities of unlabelled text** using **self-supervised learning**. LLMs emerged around 2018 and perform well at a wide variety of tasks.




Publicly Available
2019
2020
2021
2022
2023
T5
GPT-3
GShard
mT5
PanGu-α
PLUG
Ernie 3.0
Jurassic-1
CPM-2
Codex
1-4
5-8
9-10
11-12
1-3
4-6
7-10
11-12
1-4
FLAN
Yuan 1.0
T0
HyperCLOVA
LaMDA
AlphaCode
Chinchilla
Anthropic
WebGPT
Ernie 3.0 Titan
Gopher
GLaM
InstructGPT
CodeGen
MT-NLG
OPT
GPT-NeoX-20B
Tk-Instruct
Cohere
GLM
AlexaTM
WeLM
UL2
PaLM
YaLM
Sparrow
Flan-T5
Flan-PaLM
Luminous
NLLB
Pythia
Vicuna
PanGu-Σ
Bard
ERNIE Bot
LLaMA
BLOOM
mT0
BLOOMZ
Galatica
OPT-IML
ChatGPT
GPT-4

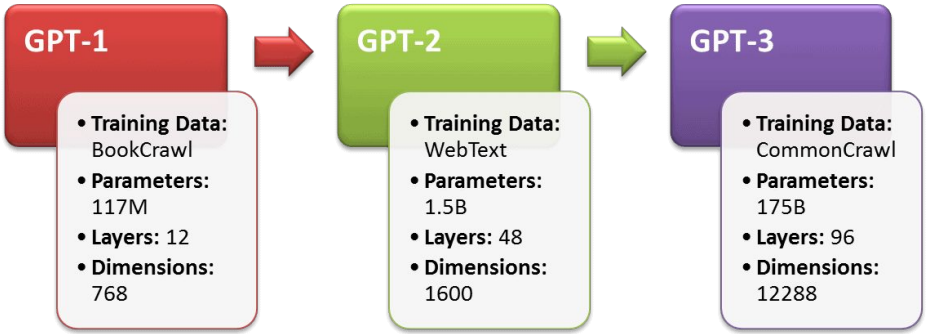
GPT in simple terms

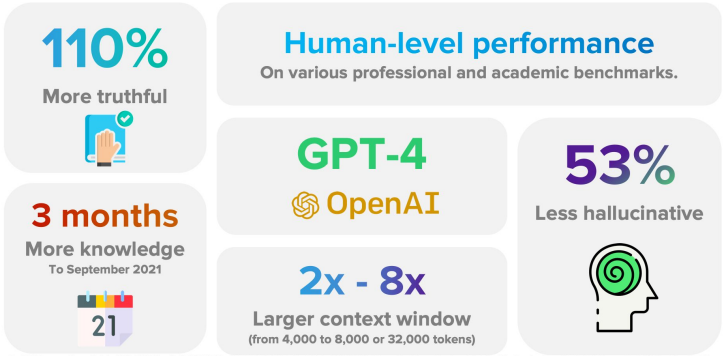
Generative : predicting next word (language model)

Pretrained : previously trained on large amounts of data

Transformer : Encoder-Decoder based neural network

Chat**GPT**: GPT fine tuned for conversations (chatbot)





Capabilities of GPT-4 on Medical Challenge Problems

Table 3: Accuracy on questions that reference visual media (images and graphs) that were not passed to the model, compared to accuracy on questions with pure text.

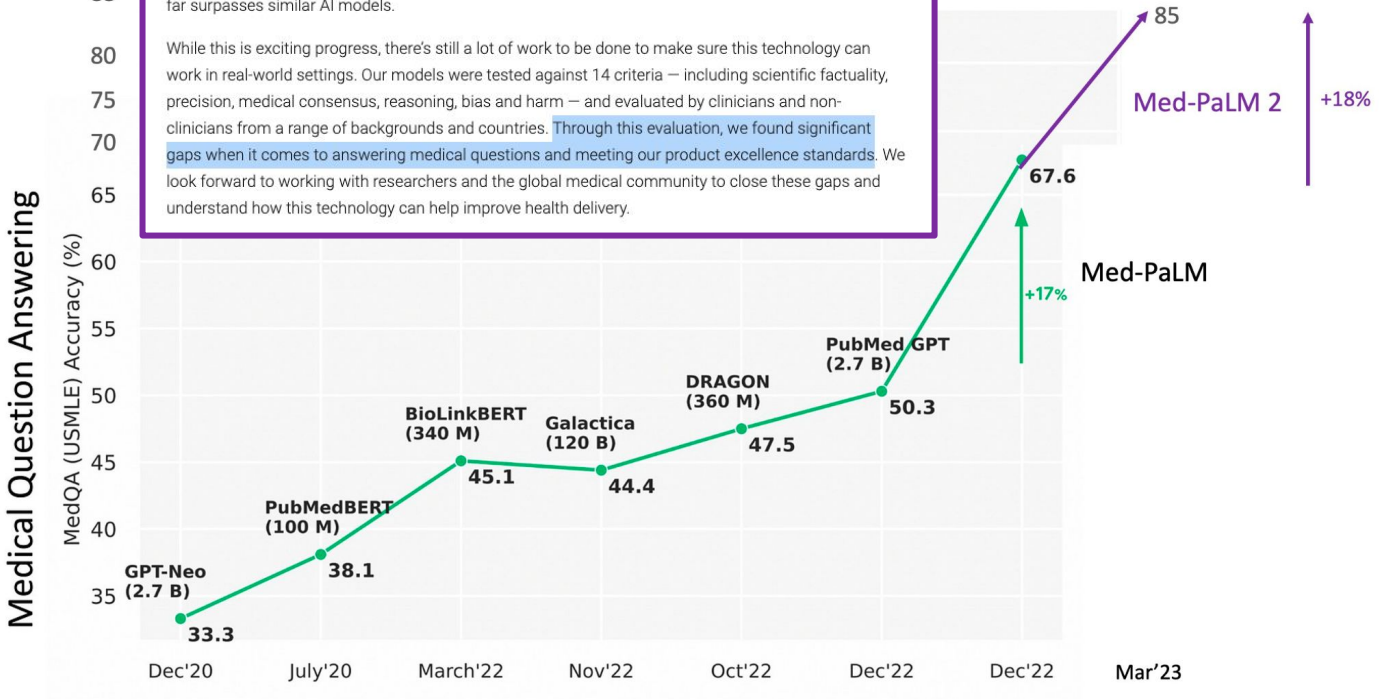
Dataset	Question Type	**GPT-4 (5 shot)**	GPT-4 (zero shot)	GPT-3.5 (5 shot)	GPT-3.5 (zero shot)
USMLE Self Assessment	Text	**89.51**	86.39	55.30	50.40
	Media	**69.75**	68.15	43.63	41.40
	All	**86.65**	83.76	53.61	49.10
USMLE Sample Exam	Text	**87.77**	85.63	59.63	57.80
	Media	**79.59**	75.51	53.06	51.02
	All	**86.70**	84.31	58.78	56.91

Nori *et al.* "Capabilities of GPT-4 on Medical Challenge Problems." *arXiv preprint 2303.13375* (2023).

MedPaLM-2 by Google on USMLE (Medical License Exam)

Recently, our next iteration, Med-PaLM 2, consistently performed at an "expert" doctor level on medical exam questions, scoring 85%. This is an 18% improvement from Med-PaLM's previous performance and far surpasses similar AI models.

While this is exciting progress, there's still a lot of work to be done to make sure this technology can work in real-world settings. Our models were tested against 14 criteria — including scientific factuality, precision, medical consensus, reasoning, bias and harm — and evaluated by clinicians and non-clinicians from a range of backgrounds and countries. Through this evaluation, we found significant gaps when it comes to answering medical questions and meeting our product excellence standards. We look forward to working with researchers and the global medical community to close these gaps and understand how this technology can help improve health delivery.



Source: https://blog.google/technology/health/ai-llm-medpalm-research-thecheckup/

If this is what human-level means and how human intelligence is measured with such exams, we may need to **reconsider how we evaluate human intelligence**.

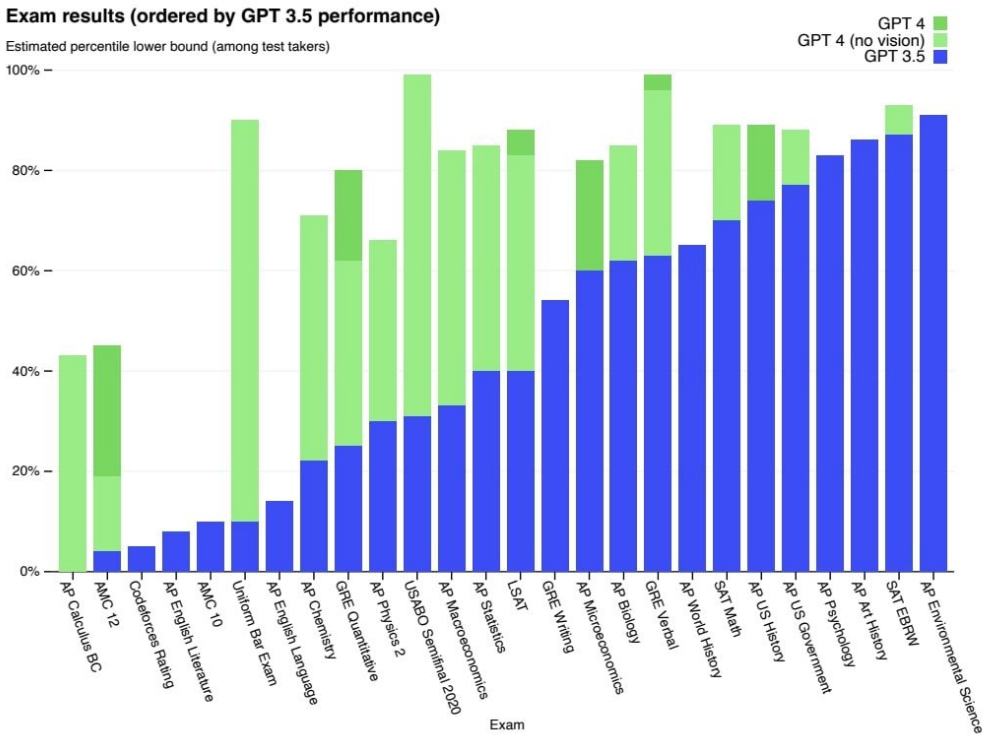
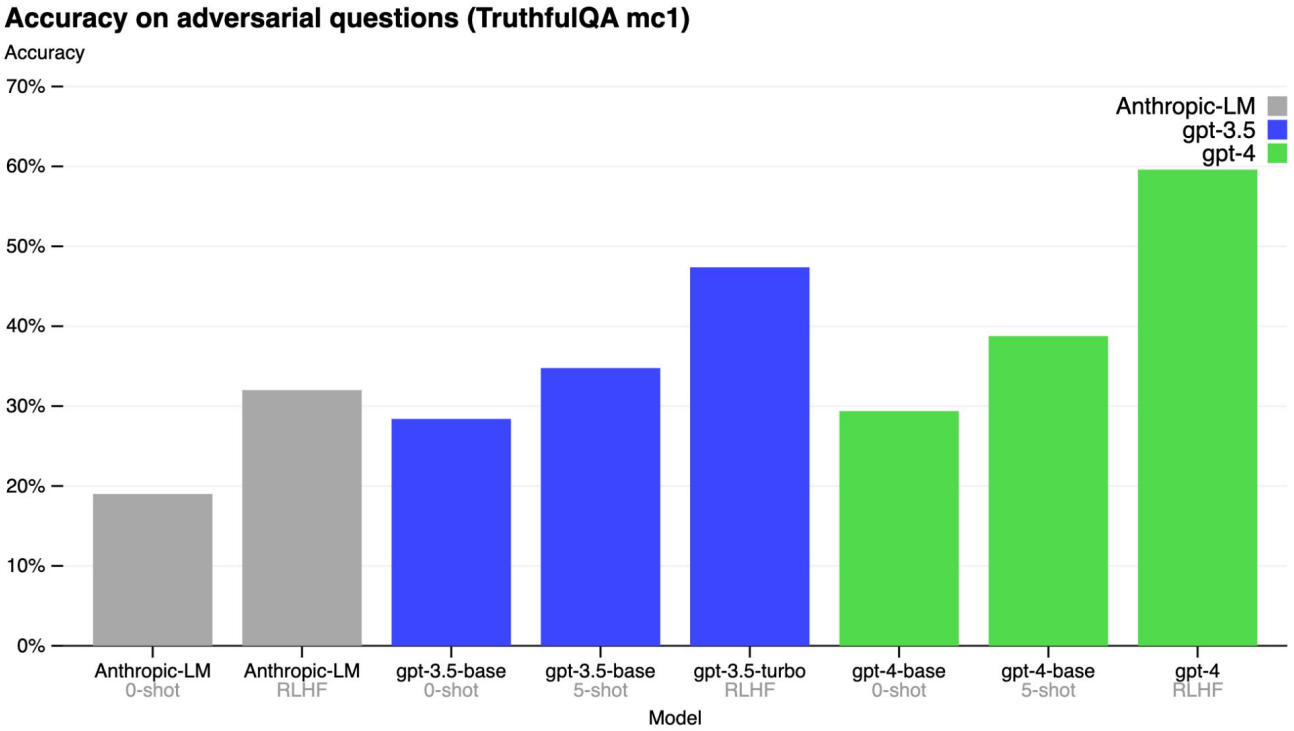


Figure 4. GPT performance on academic and professional exams. In each case, we simulate the conditions and scoring of the real exam. Exams are ordered from low to high based on GPT-3.5 performance. GPT-4 outperforms GPT-3.5 on most exams tested. To be conservative we report the lower end of the range of percentiles, but this creates some artifacts on the AP exams which have very wide scoring bins. For example although GPT-4 attains the highest possible score on AP Biology (5/5), this is only shown in the plot as 85th percentile because 15 percent of test-takers achieve that score.

OpenAI, "GPT-4 Technical Report." *arXiv preprint 2303.08774* (2023).

ChatGPT based on GPT-4 still answers > %40 of the questions incorrectly



Benefits of LLMs in Pharma and Healthcare Industry

SPEEDING UP DRUG DISCOVERY

LLMs can analyze enormous datasets of known drugs, their effects, and associated genetic factors, predicting potential new drugs or repurposing existing ones.

ENHANCED CLINICAL DECISION SUPPORT

LLMs can integrate and interpret vast quantities of medical literature, case studies, and patient data to support clinicians in making more informed decisions about treatment approaches.

PERSONALIZED MEDICINE

By analyzing individual patient data (genomics, proteomics, lifestyle, etc.), LLMs can propose tailored treatment strategies, driving the advancement of personalized medicine.

MEDICAL LITERATURE ANALYSIS

LLMs can keep pace with the rapidly expanding medical literature, synthesizing information from numerous sources, identifying trends, gaps, and novel insights.

EDUCATION AND TRAINING

LLMs can be used as advanced teaching tools, providing in-depth, personalized learning experiences for medical students, physicians, and other healthcare professionals.

Challenges of LLMs in Pharma and Healthcare Industry

DATA PRIVACY AND SECURITY

Healthcare data is highly sensitive. Ensuring privacy and compliance with regulations such as HIPAA and GDPR while using LLMs is challenging.

EXPLAINABILITY AND TRUST

The 'black box' nature of AI models can make it hard for users to understand and trust the model's recommendations. This is particularly critical in healthcare, where decisions can have significant impacts on patient lives.

BIAS IN AI

LLMs trained on existing healthcare data may perpetuate historical biases or disparities, potentially leading to unfair or ineffective treatment recommendations.

RESOURCE INTENSIVE

Training LLMs requires considerable computational resources and highly skilled personnel, which may be beyond the reach of many healthcare organizations.

Future Potential of LLMs in Pharmaceutical Industry

REIMAGINING DRUG DISCOVERY

The ability of LLMs to sift through and analyze massive amounts of data could revolutionize the drug discovery process. Predictive models could propose novel molecules for therapeutic use, or suggest new uses for established drugs.

TAILORED THERAPIES AND PERSONALIZED MEDICINE

By harnessing vast amounts of individual patient data, LLMs could propose highly personalized treatment regimens. This could drive the expansion of precision medicine, improving patient outcomes and potentially reducing healthcare costs.

IMPROVED PHARMACOVIGILANCE

By monitoring and analyzing patient reports, medical literature, and social media, LLMs could improve drug safety surveillance, quickly identifying potential drug side effects or interactions.

ENHANCING CLINICAL TRIALS

LLMs could help to refine patient selection, monitor trial progress, analyze results, and even predict trial outcomes. This could streamline the clinical trial process, reducing costs and accelerating drug development.

ENABLING ADVANCED DRUG REPURPOSING

LLMs could play a vital role in drug repurposing efforts by recognizing patterns and links between various diseases and available drugs, leading to more efficient use of existing treatments.

PIONEERING DIGITAL THERAPEUTICS

As the basis for advanced digital health applications, LLMs could provide personalized health advice, self-care guidance, and therapeutic support, reaching patients who may have limited access to traditional healthcare services.

Case Studies by John Snow Labs

Accelerating clinical risk adjustment through Natural Language Processing

Automated Classification and Entity Extraction from essential documents pertaining to Clinical Trials

Accelerating Biomedical Innovation by Combining NLP and Knowledge Graphs

Improving Drug Safety With Adverse Event Detection Using NLP

Identifying opioid-related adverse events from unstructured text in electronic health records

Adverse Drug Event Detection Using Spark NLP

Deep6 accelerates clinical trial recruitment with Spark NLP

Using Spark NLP to build a drug discovery knowledge graph for COVID-19

Expert Panel Discussion

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Moderators:
Dr. Maikel Boot & Dr. João Guerreiro -
Technical Directors Healthcare & Life Science @ PreScouter

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MEET THE EXPERT

Kyle Tretina, PhD

Alliance Manager, AI Platforms at Insilico Medicine

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Amir Emadzadeh, PhD

Director of Software Development & AI, Genentech

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MEET THE EXPERT

Punitee Garyali MD, PhD

Franchise Head Clinical - Oncology, PathAI

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MEET THE EXPERT

Veysel Kocaman, PhD

Head of Data Science,
John Snow Labs

Which current applications of AI in pharma do you consider to be most promising and why? Where does LLM fit into that?

Where do you see the biggest impact (cost, time saving) of AI in Pharma, currently? Can you describe that impact?

What are some impactful steps or stages within Drug Development AI has yet to play a significant role in? Why or what is missing for that to happen?

How can ROI be measured and then be used to convince company stakeholders or investors of the value of implenting AI?

In order for a big pharma/biotech company to maximize the value of AI, would you advise them to build or buy and how would that impact the timeline for a MVP?

What are the key drivers/best practices for successful implementation of AI for pharma/biotech?

Rapid Questions

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Thanks for attending:

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If you're interested to learn more, connect with Jeremy at jschmerer@prescouter.com or scan the QR code below:

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