

Code to Cognition: Overview & Trends in Artificial Intelligence

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Introduction to Artificial Intelligence

- In embarking upon an exploration of AI products and their transformative potential, it is imperative to first delve into the foundational concept of intelligence itself. The fundamental question: *What is intelligence*?
- At its core, intelligence has been characterized as the capacity to resolve complex challenges. Yet, this leads us to ponder whether mere problem-solving, as exhibited by a calculator, qualifies as intelligence.
- What differentiates truly intelligent systems from mere computational tools? We unravel the nature of these complex problems, their natural resolution mechanisms, and the potential for their replication in artificial systems.
- We then navigate through the history of AI, explaining how computational power and its associated costs have historically impeded AI's progress for decades.
- The history of AI illuminates the question: *Why now*? Why is this moment in history ripe for pioneering, investing, and actualizing the potential of AI?

Defining Intelligence

Intelligence is the ability to solve complex problems – such as analyzing information, creating new solutions, adapting to situations, and managing social relationships







There are 6 outputs of intelligence created by the human brain



Defining Artificial Intelligence

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Al is a machine's ability to create the outcomes of intelligence





Machine Learning

Computer Linguistics

Computer Vision

Computer Audition

Networks

Robotics



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Access to improved compute and funding has sped up AI adoption

250 1	956	1963
Turing's Test First test for AI where where indistinguishable answers of a machine & human would deem the machine intelligent	Dartmouth Workshop The term "Artificial Intelligence" was coined and defined as the field of study that helps replicate human intelligence in machines	 Symbolic AI & Financing Evolution of Natural Language Evolution of If-Else Logic Increased funding at MIT
87 1	980	1974
Second Al Winter Slowdown in funding due to • Limited adoption by commercial vendors • Tech was still not viable	Al Boom Evolution of 1st, 2nd gen computers, calculators Use of data in decision making increases Extensive funding in Japan on Al research 	First Al Winter Slowdown in Al funding due to • Lack of data, limited computing power • Expensive and time consuming
93 2	009	2018
Moore's law Next generation processors provided enormous speed; Speed and memory started doubling every 2 years	Deep Learning & Big Data Creation of artificial neural networks Emergence of Big Data management tools to process enormous amounts of data	Artificial General Intelligence Foundation models like GPT3 by OpenAl and Gato by DeepMind act as the first step to achieving artificial general intelligence

Creating Artificial Intelligence



Intelligence in machines is created by 4 pieces of hardware



Creating Artificial Intelligence

Computers are imbued with intelligence using the following methods

	Supervised Learning	Unsupervised Learning	Reinforced Learning
Explanation	Learning from pre-labelled data	Learning from unclean and unlabeled datasets	Learning by observing and interacting with the environment
Techniques	 Regression: Finding relationship between 2 variables Classification: Classifying datapoints into a group based on pre-defined categories 	 Clustering: Classifying datapoints into groups based on undefined categories Association: Identifying patterns in underlying data 	 Deep Learning: Teaching your brain to recognize things by showing it a lot of examples Policy Learning: Finding best way to do something using lots of examples
	x1	x1	
Use Case	Prediction of weather based on atmospheric conditions	Finding boundaries of a product in an image	Learning to play chess by winning/losing

What will AI unlock?

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AI makes us better at doing tasks, similar to other digital inventions

 Improve Productivity
 Unleash Creativity
 Better Decisions

 Reduces time, costs,
 Civing life to your imagination
 Easter data analysis, instance

requirement of multiple people on a single tasks Giving life to your imagination without having artistic ability

Faster data analysis, insight generation and decision making







Is it the right time to invest in AI?



Enormous Models Power of AI models outpacing Moore's law



Accessibility and Ease of Use Cheaper compute; Better UI/UX provided by LLMs



Access and computation power of AI models has made AI output meaningful

Where we are today?

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Machine Learning	Technology allowing machines/computers to make decisions without being explicitly programmed
Artificial Intelligence	Simulation of human intelligence processes by machines/computers
Artificial General Intelligence (AGI)	Theoretical AI that can behave exactly similar to a human
Neural Network	Computer model inspired by human brain with interconnected nodes of data connected in layers
LLMs	ML model trained over large amounts of language data to produce meaningful output in a given context
GPT	Generative Pretrained Transformer (GPT) is a type of LLM that uses natural language to generate human like text
Diffusion Models	Type of ML models that predicts how information spreads from one coordinate to another – used in image generation



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Al Tech & Product Landscape

• While looking at AI product landscape, it becomes essential to conceptualize the Foundation Model:

Standalone AI models capable of adaptation across a myriad of applications.

- This creates a market for essential "**building blocks**" tailored to these foundational models alongside the "**applications**" that can be innovatively crafted atop them.
- The advent of models like GPT-3 and GPT-4 has catalyzed a surge in research and development efforts, extending beyond linguistics to encompass other outputs of intelligence, including vision and audition.
- We then look at the **4-P framework** of AI's impact, which encompasses a reduction in dependence on **people**, improved **productivity** of individuals, increased **programmability** of processes, and enhanced **precision** of their outputs.

Artificial Intelligence Investment Landscape

There are three kinds of products in the AI Product Landscape



Al Infrastructure and Tooling

Building blocks for AI assist in processes before, during & after model training



Al Infra & Tooling

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Foundation Models for AI

There are various foundation models based on the outputs of intelligence

	Linguistics	Vision	Audition	Robotics	Reasoning
Туре	Text	Images & Videos	Audio	Multimodal	Tables & Vectors
Purpose	Understand & generate textual patterns	Understand & generate visual patterns	Understand & generate auditory patterns	Software controlling hardware	Understanding patterns in quantitative and qualitative data
Example	Language translation	Object recognition	Improving sound quality	Smart Homes	Diagnostics, Planning, Forecasting
Companie s	SOpenAI	Midjourney stability.ai	Eleven Labs VALL-E	Boston Dynamics	DataRobot OpenAl Codex

Computer Linguistics: Underlying Technology

Large Language Models (LLMs) are AI models that can understand and generate human language



Computer Linguistics: Evolution

OpenAI has commoditized the technology to build computer linguistics applications with **several unicorns leveraging GPT4, Llama**



Computer Vision

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Models in computer vision are yet to achieve perfection with research ongoing by 3 large players



Power (Number of images used for training)

Pros

Cons

Example

(Prompt: A beautiful Sri lankan woman wearing traditional clothes half immerged in the Ganges river looking at the camera with an hypnotizing glare)

Foundation Models

Computer Audition



Different Open Source Audio Al models are available

😔 Hugging Face	Speech			Sing Audio		dio	
AudioGPT Modules (Open Source)	Text-to- speech	Speech Recognition	Style Transfer	Speech Translation	Text to Sing	Text-to- Audio	Audio Inpainting
Definition	Converting written text to speech	Recognizing speech coherency	Changing tone by varying frequency & amplitude	Converting from one language to another	Making songs from written lyrics	Turning text into speech	Filling in gaps in audio
Ez Dubs	<u>Real-tin</u> dubbing preserving and emo	me while g voice otions	INSANE FT. ARIANA GRANDE	<u>Ariana Grande</u> <u>singing Insane</u> <u>in Punjabi</u>		Do Sp Sp Ia	nald Trump eaking in 6 anguaged



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R&D companies are building highly efficient robots with industrial use



Reasoning: Diagnostics, Planning and Forecasting

Multiple steps in business processes are getting automated by AI





Applications

Al applications: Measuring Impact

AI applications can be identified on the basis of the **impact they create**

People	# of FTEs in industry	Acts as a proxy for numerical impact. More the number of people within a function and use case, more is the potential business impact created by AI.		
Productivity	# hours spent per FTE annually	Acts as a proxy for value impact. More number of hours and more value of work of		
Productivity	FTE salary or wage per hour	an individual, more is the potential business impact created by AI.		
Programmability % manual work vs % digitized individual is co		Digitization of an individual's workflow is necessary for AI adoption. If the individual is completely offline, it is hard for AI to create value.		
Precision	Margin for error in use case	Use cases having low margin for error, and high cost burden of an error are areas		
	Cost of an error	where AI would create the maximum impact.		

Applications



2 Artificial Intelligence Tech & Product Landscape

(3) Potential Themes for Entrepreneurs

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Potential Themes for Entrepreneurs

- After defining the potential impacts of AI, we now dive deeper into the themes across the largest markets for AI applications: software development, healthcare, banking, financial services and insurance (BFSI), consumer packaged goods (CPG) & Retail, and Media & Creator Technology.
- In the context of India, a nation burgeoning with entrepreneurial talent, the prospects for creating AI-driven products are not only global in scope but also hold immense promise for addressing uniquely Indian challenges.
- The development of Indian-language LLMs unlocks several India-focuses use cases, instrumental in extending the reach of AI to rural India and democratizing access to AI and its benefits.
- Moreover, AI presents a pivotal opportunity to redefine the very essence of entrepreneurship. It fosters the emergence of novel business models, go-to-market (GTM) strategies, and competitive advantages, thereby levelling the playing field for even the most nascent yet talented founders to build in this domain.

Interesting Themes in AI Applications





Interesting Applications in Software Development

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Events & messaging, Virtualization & DevOps are high-value pool

Tech Stack Components	Technologies	Definition	Associated Value / comp	AI Feasibility	AI Tools
Frontend	JS, React, Angular, HTML, CSS	Developing interfaces for input/output	\$75K	High	Style 🔓 Locofy
Programming Languages	Node, Java, Python, PHP	Writing custom logic	\$113K	High	GitHub Copilot
App Frameworks	Spring, Django, iOS, Java, Android	Enabling standards for building apps	\$146K	Moderate	Debuild 阏 Enzyme
Database	MongoDB, MySQL	Querying, managing, organizing data	\$146K	High	Comparative Al 2sql*
Event & Messaging	Kafka	Enabling 2-way real time communication	\$123K	High	Seek
Virtualization & DevOps	Kubernetes, Docker	Making code efficient and organized	\$123K	Moderate	🎄 KUBIYA

Interesting Applications in Health

Potential to augment Clinical Decision Making & Drug Discovery using Al

Clinical	Decision Making	Physician Workflow	Pharmaceuticals; Biotech & Drug Discovery	
LLMS	Chat GPT 🚫 Bard Al Authorization of treatment		Identification of patterns in protein sequences using GPT4	
Proprietary	EHR, EMR, Medical Financial clearance and claims Journals, Clinical		Predicting outcomes of chemical reactions	
	Images, Lecture Slides	Writing diagnostics, medical coding, etc. (workflow)	Analytics in drug discovery pipeline	
Diagnostics	© GLASS	Olive	Insilico Medicine	
Treatment	kaliberai" - Sonaliz	BIONIC HEALTH	🐤 Exscientia	
Monitoring	Biofourmis	© GLASS	PathAl	
Strong p	roduct moat possible	Difficult to establish right to win, tech moats	High value play; Limited moats in India	

Interesting Applications in Banking & Financial Services

AI will disrupt several repetitive and SOP based processes in fintech



Interesting Applications in Consumer Goods & Retail

CPG/Retail one of the first industries to accept ML; AI will follow



Interesting Applications in Media and Creator Tech

Video emerges as the next big disruption in content creation using Al



The Rise of India LLMs

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LLMs built for 750+ Indian languages to expand AI usage to rural India



Common go-to-market strategies in Al

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GTM still being discovered; Build in Public, a special kind of PLG is popular







Al applications can win with proprietary data and distribution; Infra and building blocks can win with a unique product

	Infrastructure & Tooling	Foundation Models	Applications
Underlying Technology	Can be proprietary IP	Can be proprietary IP	Usually no IP
Engineering Effort	Should be high	Should be high	Usually limited engg. effort
Data Availability	Independent of data	Data should be easily available	Should be proprietary / unique
Distribution Effort	Usually low-effort digital	Usually low-effort digital	Distribution should require effort and channels
What should be the right to win?	High engineering effort and/or proprietary IP	High engineering effort and/or proprietary IP	Proprietary data and locked distribution channels
	Pinecone 🗽 🖉 LangChain 🚊 FINIE	SOpenAI 😣 Hugging Face 🖉 Midjourney	🔾 Jasper Harvey. 隊 Profluent

The Ideal AI Founder Persona

Opportunity for young founders to create AI Infra and Middleware



