The Evolution of AI: Predictive, Generative, and Agentic

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From Prediction to Agency

Understanding the paradigm shift in Artificial Intelligence.

A Timeline of AI Capabilities

1. Predictive AI

- Goal: Forecast and Classify
- Focuses on analyzing historical data to predict future outcomes or categorize inputs.

A Timeline of AI Capabilities

2. Generative AI

- Goal: Create and Ideate
- Focuses on learning patterns to generate new, original content (text, image, code).

A Timeline of AI Capabilities

3. Agentic AI

- Goal: Act and Solve
- Focuses on autonomous decision-making and tool usage to achieve multi-step goals.

Predictive AI: The Foundation of Machine Learning

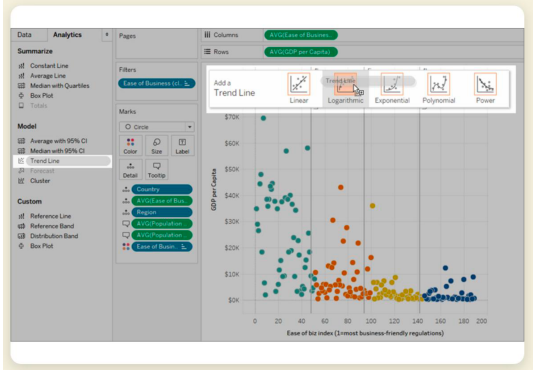
Predictive AI, often referred to as “Traditional AI” or “Discriminative AI,” is designed to perform a specific task by analyzing data and making a decision or prediction.

Function: Maps input variables to output classes or values.

Mechanism: Minimizes error between predicted and actual outcomes based on training data.

Key Question: “Based on the past, what is likely to happen next?”

Predictive AI: The Foundation of Machine Learning



Predictive AI Techniques

Regression: Predicting continuous values, such as housing prices, stock trends, or disease progression scores based on input features.

Classification: Categorizing data into distinct classes, such as spam detection, medical diagnosis (Benign vs. Malignant), or image recognition.

Clustering: Unsupervised learning to find hidden structures or groups within data, often used for customer segmentation or genomic analysis.

Generative AI

Generative AI represents a shift from analyzing existing data to creating new data. It learns the underlying probability distribution of a dataset to generate novel samples similar to the original.

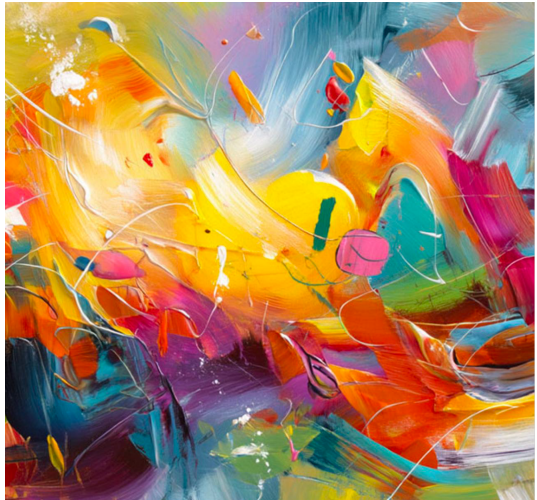
Generative AI

Creation vs. Prediction: Unlike predictive models that output a label or number, GenAI outputs complex artifacts like essays, realistic images, functional code, or synthetic biological data.

Core Mechanism: Large Language Models (LLMs), Diffusion Models, and Generative Adversarial Networks (GANs).

Key Question: "Can you create something new that looks like what you've seen before?"

Generative AI



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Powering Generative AI

Large Language Models (LLMs): Built on the Transformer architecture, these models use self-attention mechanisms to predict the next token in a sequence. They excel at understanding context, summarization, and translation.

Diffusion Models A class of models that generate high-quality images by gradually removing noise from a random signal. They are the engine behind powerful text-to-image synthesis tools.

Agentic AI

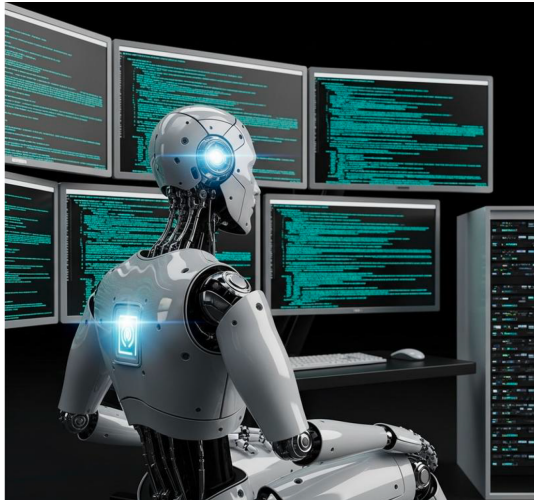
Agentic AI refers to systems that can autonomously perceive, reason, and act to achieve high-level goals. They don't just "talk"; they "do."

Autonomy: Capable of planning multi-step workflows without constant human intervention.

Tool Use: Can browse the web, write and execute code, or query databases.

Looping: Operates in a "Perception-Action-Observation" loop to correct errors and refine strategies.

Agentic AI



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The Architecture of Agency

Perception (Sensors): The agent gathers information from its environment (e.g., reading a file, browsing a webpage, or receiving a user prompt).

Reasoning (Brain): Usually an LLM that breaks down the goal into a plan, decides which tools to use, and reflects on past outputs.

Action (Tools): The execution layer where the agent utilizes APIs, calculators, or code interpreters to effect change or retrieve data.

Comparative Analysis

Feature	Predictive AI	Generative AI	Agentic AI
Primary Goal	Forecast accuracy & Classification	Content creation & Human-like response	Task completion & Autonomous action
Interaction	Input $\rightarrow$ Class/Value	Prompt $\rightarrow$ Response (Chat)	Goal $\rightarrow$ Multi-step Workflow
Output	Numbers, Labels, Probabilities	Text, Images, Audio, Code	Completed Tasks, API Calls, File Edits
Reasoning	Statistical correlations	Pattern matching & Probability	Planning, Reflection, & Tool Selection

The Future: Multi-Agent Systems

We are moving towards ecosystems where specialized agents (coders, researchers, designers) collaborate to solve complex problems.

The role of humans is shifting from “operator” to “manager” of these agent swarms, focusing on high-level strategy and oversight rather than execution detail.

Questions & Discussion

Thank you for your attention.

Session Info

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## Running under: macOS Tahoe 26.1
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## LAPACK: /Library/Frameworks/R.framework/Versions/4.5-arm64/Resources/lib/libRlapack.dylib;  LAPACK version 3.12.1
##
## locale:
## [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
##
## time zone: America/Denver
## tzcode source: internal
##
## attached base packages:
## [1] stats     graphics  grDevices utils     datasets  methods   base
##
## other attached packages:
##  [1] lubridate_1.9.4 forcats_1.0.0   stringr_1.5.1   dplyr_1.1.4
##  [5] purrr_1.1.0     readr_2.1.5     tidyr_1.3.1     tibble_3.3.0
##  [9] tidyverse_2.0.0 caret_7.0-1     lattice_0.22-7  ggplot2_3.5.2
## [13] knitr_1.50
##
## loaded via a namespace (and not attached):
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