

# GENERATIVE AI

## CHEAT SHEET



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# What is Artificial Intelligence and How Generative AI Fits In

Artificial Intelligence (AI) refers to systems designed to perform tasks that normally require human intelligence, such as understanding language, recognizing patterns, making decisions, or learning from experience.

Traditional AI systems were mostly rule-based, meaning humans explicitly told machines what to do using predefined logic. These systems worked well for predictable problems but struggled with complexity and uncertainty.

Generative AI is a subfield of AI that goes beyond decision-making or classification. Instead of just identifying patterns, Generative AI can create new content such as text, images, code, audio, or video. It learns from massive datasets and generates outputs that resemble human-created content. This ability to create, not just predict, is what makes Generative AI transformative.

## Key Distinction

**Traditional AI:** Follows rules, classifies, decides

**Generative AI:** Creates new content, adapts, innovates

The shift from analysis to creation represents a fundamental paradigm change in how we deploy intelligent systems.

# Machine Learning Fundamentals (Why Data Matters)

Machine Learning (ML) is the foundation on which Generative AI is built. In ML, systems learn patterns from data instead of being explicitly programmed. The more high-quality data a model sees, the better it learns relationships and structures within that data.

There are different types of ML, but Generative AI relies heavily on unsupervised and self-supervised learning, where models learn from raw data without explicit labels. For example, a language model learns grammar, facts, and reasoning simply by predicting the next word in a sentence across billions of examples. This learning process allows the model to generalize and generate new content.



## Pattern Recognition

Identifying recurring structures in massive datasets



## Continuous Learning

Models improve as they process more examples



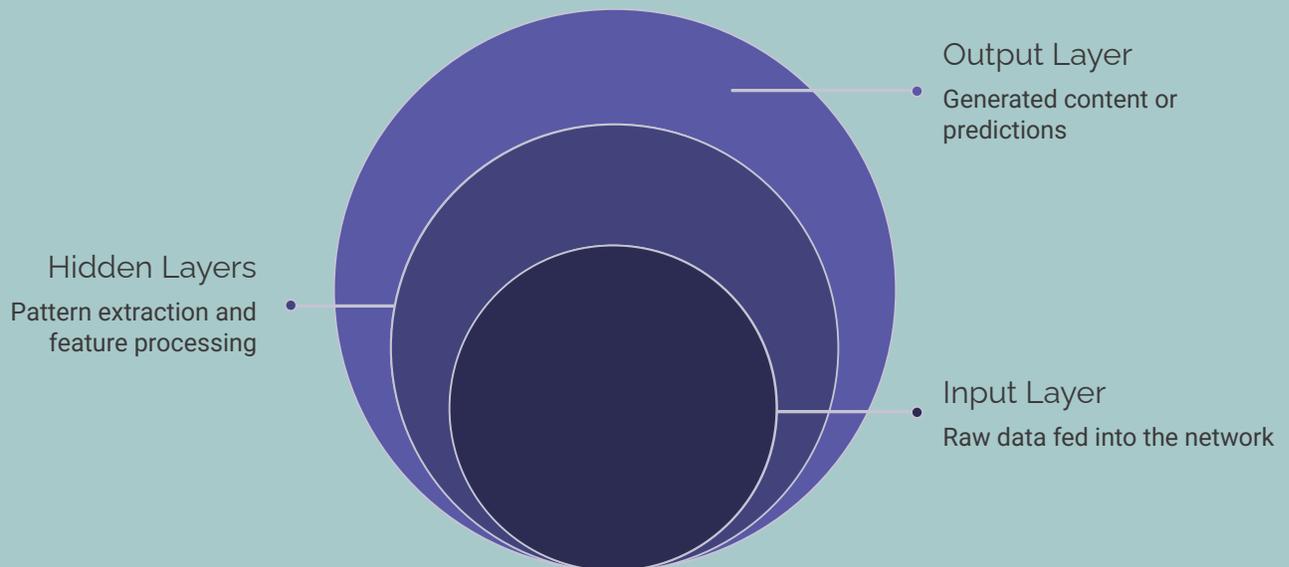
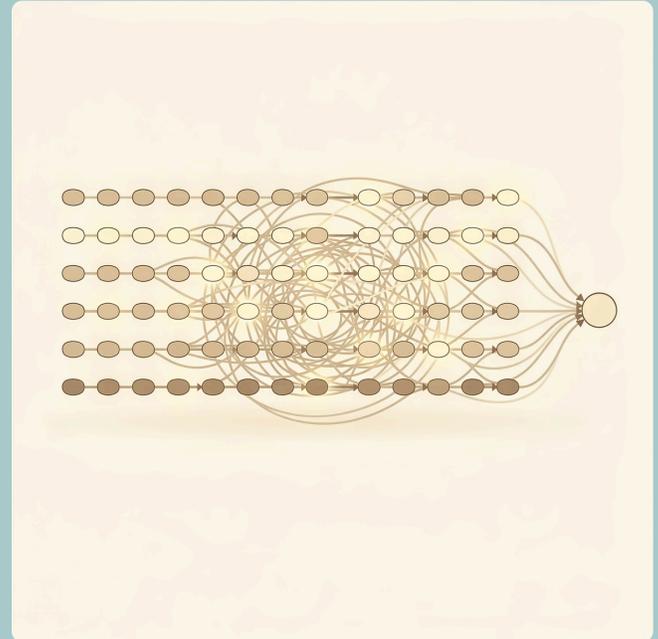
## Generalization

Applying learned patterns to new, unseen scenarios

# Deep Learning and Neural Networks (The Brain Behind GenAI)

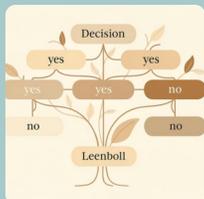
Deep Learning is a subset of Machine Learning that uses neural networks inspired by the human brain. These networks consist of layers of interconnected nodes that process information progressively from simple to complex patterns.

In Generative AI, deep neural networks allow models to understand context, relationships, and structure in data. For example, in text generation, early layers might learn grammar, while deeper layers learn meaning, tone, and intent. Without deep learning, Generative AI would not be able to handle complex tasks like conversation or creative writing.



This layered architecture enables the sophisticated content generation capabilities that define modern Generative AI systems.

# Generative vs Discriminative Models (Core Concept)



## Discriminative Models

Focus on classification or prediction. They answer questions like: Is this transaction fraudulent or not? or Is this email spam or safe? They learn decision boundaries between classes.



## Generative Models

Learn the entire data distribution. This allows them to generate new data that looks similar to the original. Instead of deciding what something is, generative models focus on how something could be created.

**Key Insight:** Generative models don't just classify—they understand the underlying structure well enough to create entirely new, statistically coherent outputs. This is why Generative AI can write essays, generate images, or simulate conversations.

# What is Generative AI? (Definition and Capabilities)

Generative AI refers to AI systems capable of creating original outputs such as text, images, code, music, or videos based on learned patterns from data. These systems do not copy existing content verbatim but generate new variations that are statistically and contextually coherent.

Its capabilities include natural language generation, summarization, translation, question answering, image creation, code writing, and even reasoning through multi-step problems. Generative AI can adapt to different tones, styles, and objectives when guided properly. This flexibility makes it useful across industries.



## Text Generation

Create articles, emails, reports, and conversational responses with contextual awareness



## Visual Creation

Generate original images, designs, and visual content from text descriptions



## Code Development

Write, debug, and optimize code across multiple programming languages



## Creative Problem-Solving

Reason through complex, multi-step challenges with adaptive approaches

# Evolution and Industry Impact of Generative AI

Early generative systems were limited and domain-specific. With the introduction of deep learning and large-scale data, models became significantly more powerful. The real breakthrough came with foundation models trained on massive datasets that could be adapted for many tasks.

Industries such as finance, healthcare, marketing, software development, and education have adopted Generative AI to improve efficiency, creativity, and decision-making. Instead of replacing humans, it primarily augments human capabilities. The speed of innovation has made Generative AI a strategic business asset.



## Finance

Risk analysis, reporting,  
compliance

## Healthcare

Diagnosis support,  
research acceleration

## Marketing

Content creation,  
personalization

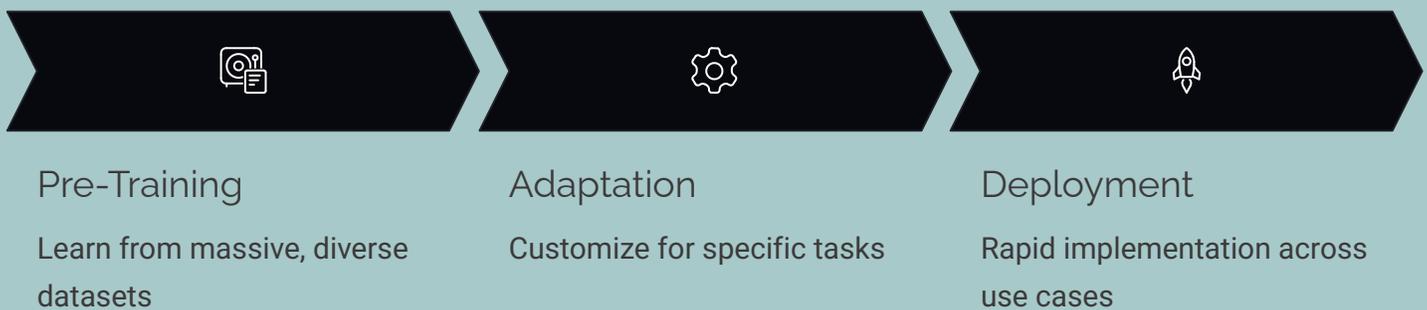
## Development

Code generation,  
debugging

# Foundation Models (Why One Model Can Do Many Tasks)

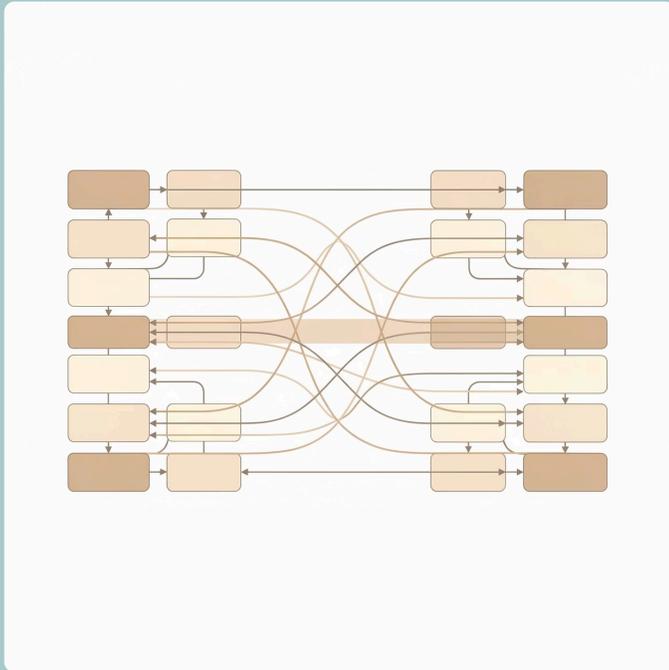
Foundation models are large, pre-trained models that serve as a base for multiple downstream tasks. They are trained on diverse datasets and learn general-purpose knowledge about language, images, or code.

Once trained, these models can be adapted using prompt engineering, fine-tuning, or retrieval mechanisms. This reduces development time and cost. Foundation models are the reason a single AI system can summarize documents, answer questions, write emails, and generate code.



- ❏ **Strategic Advantage:** Foundation models dramatically reduce the resources needed to build AI applications. Organizations can leverage pre-trained capabilities rather than building from scratch, accelerating time-to-value.

# Transformers and Self-Attention (How GenAI Understands Context)



Transformers are the dominant architecture behind modern Generative AI. Unlike older models that processed data sequentially, transformers process information in parallel. This makes them faster and better at handling long-range dependencies.

The key innovation is self-attention, which allows the model to understand which parts of the input are most relevant to each other. For example, it can relate a pronoun to a noun mentioned several sentences earlier. This is why modern language models can maintain context across long conversations.

## Parallel Processing

Analyzes entire sequences simultaneously rather than word-by-word, dramatically improving speed and efficiency

## Self-Attention Mechanism

Dynamically weighs the importance of each word relative to others, capturing complex relationships across long distances

## Contextual Understanding

Maintains coherence across extended conversations and documents by tracking multiple threads of meaning

# Large Language Models (LLMs)

Large Language Models are a type of Generative AI trained specifically on text. They learn language structure, reasoning patterns, and factual knowledge by predicting the next word repeatedly at massive scale.

LLMs can perform many tasks without task-specific training, simply by changing the prompt. They are used for chatbots, summarization, translation, coding assistance, and research support. Their strength lies in versatility rather than narrow specialization.



## Conversational AI

Natural dialogue systems that understand context, maintain conversation history, and provide relevant responses



## Content Summarization

Distill lengthy documents into concise summaries while preserving essential information and context



## Development Assistance

Generate, debug, and optimize code across multiple languages with contextual understanding

The versatility of LLMs comes from their ability to understand the underlying structure of language, not just memorize patterns—enabling them to adapt to new tasks through simple instruction.

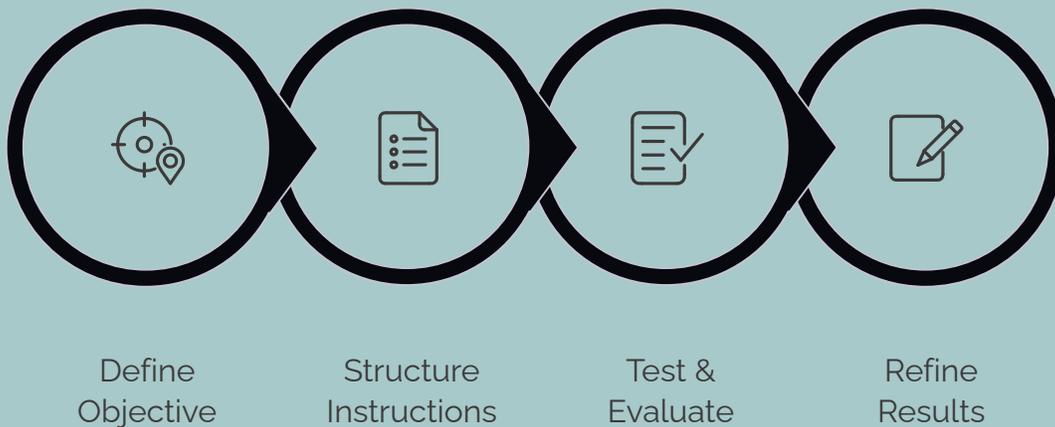
# Prompt Engineering (How Humans Control GenAI)

## What Makes a Good Prompt?

- Clear context and role definition
- Specific task instructions
- Relevant examples or constraints
- Desired format or structure
- Iterative refinement based on outputs

Prompt engineering is the practice of designing inputs that guide Generative AI toward desired outputs. A prompt provides context, role, task, constraints, and examples.

Good prompts reduce ambiguity and hallucinations. Iterative refinement improves output quality. Prompt engineering is essential because Generative AI responds differently based on how instructions are framed. It is a core human skill in working with AI systems.



Mastering prompt engineering empowers teams to extract maximum value from AI systems without requiring technical expertise in model development or machine learning.

**Pro Tip:** Start with specific examples of desired outputs. The model learns patterns from your examples and applies them to new scenarios, dramatically improving consistency.

# Fine-Tuning and Customization

Fine-tuning involves retraining a pre-trained model on domain-specific data. This helps align the model with specialized vocabulary, tone, or tasks.

While powerful, fine-tuning is costly and requires governance. Many organizations prefer retrieval-augmented generation (RAG), which keeps the model general but grounds outputs in trusted data. The choice depends on accuracy needs, budget, and risk tolerance.

1

## Fine-Tuning Approach

**Best for:** Highly specialized domains requiring consistent terminology and style

**Considerations:** Higher cost, requires quality training data, longer implementation time

**Use cases:** Legal document generation, medical diagnosis support, industry-specific analysis

2

## RAG Approach

**Best for:** Dynamic knowledge bases and factual accuracy requirements

**Considerations:** Lower cost, faster deployment, easier to update and maintain

**Use cases:** Customer support, internal knowledge management, real-time information retrieval

## Decision Framework

- Evaluate accuracy requirements
- Assess budget constraints
- Consider maintenance overhead
- Review regulatory compliance needs

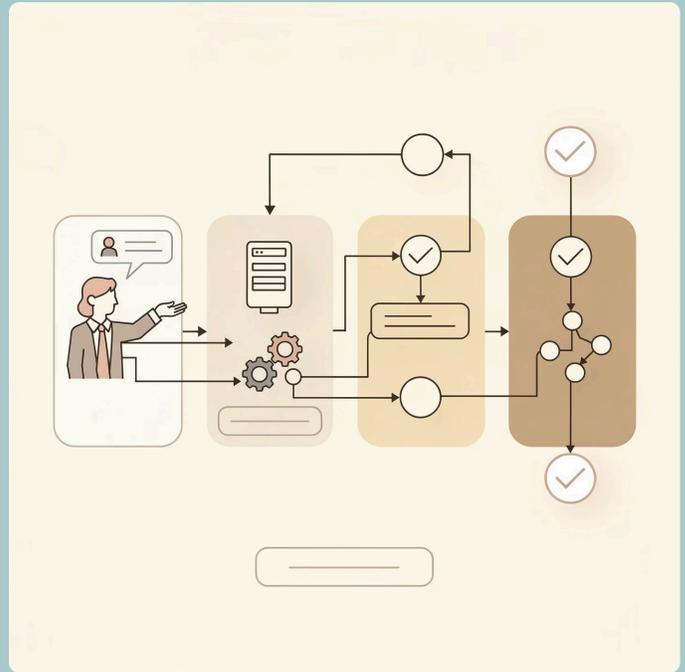
## Hybrid Strategies

Many organizations combine both approaches, using fine-tuning for core capabilities while leveraging RAG for knowledge that changes frequently or requires attribution.

# Agentic AI (Next Evolution)

Agentic AI systems go beyond single responses. They can plan, reason, and take multiple actions to achieve a goal. These systems break tasks into steps, evaluate progress, and adapt dynamically.

Agentic AI is useful for autonomous workflows such as research, monitoring, and multi-step problem solving. However, strong guardrails are required to ensure safety and control. Humans remain accountable for outcomes.



01

## Goal Understanding

Interpret high-level objectives and constraints

02

## Task Decomposition

Break complex goals into actionable sub-tasks

03

## Dynamic Execution

Execute steps while adapting to new information

04

## Progress Evaluation

Assess outcomes and adjust strategy as needed

05

## Result Validation

Verify goal completion and quality standards

📌 **Critical Note:** Agentic systems require robust safety mechanisms, clear boundaries, and human oversight. Organizations must implement monitoring, approval workflows, and fallback mechanisms before deploying autonomous agents in production environments.

# Human–AI Collaboration (Why Humans Still Matter)

Generative AI works best when paired with human judgment. Humans provide goals, context, ethical boundaries, and final validation.

AI accelerates work, but humans ensure correctness, empathy, and responsibility. Human-in-the-loop systems reduce risk and increase trust. Collaboration, not replacement, is the real value proposition.



## Strategic Direction

Humans define objectives, success criteria, and strategic priorities that AI systems execute against



## Quality Assurance

Human expertise validates AI outputs for accuracy, appropriateness, and alignment with organizational standards



## Ethical Oversight

Humans ensure AI applications respect privacy, fairness, and social responsibility throughout deployment

"The most powerful AI applications emerge from thoughtful human-AI collaboration, where each contributes their unique strengths—human judgment, creativity, and empathy combined with AI speed, scale, and pattern recognition."

# Ethical and Responsible Use of Generative AI



Generative AI can amplify bias, misinformation, and privacy risks if not governed properly. Responsible AI focuses on fairness, transparency, and accountability.

Organizations must ensure data privacy, explainability, and compliance with regulations like the EU AI Act. Ethical deployment builds long-term trust. Governance frameworks are essential for sustainable adoption.



## Fairness & Bias Mitigation

Regular audits to identify and address discriminatory patterns in training data and model outputs



## Transparency & Explainability

Clear documentation of model capabilities, limitations, and decision-making processes



## Privacy Protection

Robust data handling practices ensuring user information security and regulatory compliance



## Accountability Frameworks

Clear ownership structures and incident response protocols for AI system outputs and impacts

# GENERATIVE AI FOUNDATION CERTIFICATION



## ABOUT GSDC CERTIFICATION



### EBOOK

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- Apply knowledge using ready-to-implement templates
- Demonstrate ability to work with Agentic AI models
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