Arab Dialogue Circle on
"Artificial Intelligence in the Arab World"
Innovative Technologies & Ethical Challenges

NAIF ARAB UNIVERSITY
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دائرة الحوار العربي حول
الذكاء الاصطناعي في العالم العربي
تطبيقات مبتكرة وتحديات اخلاقية

Navigating the Future of Language-Driven AI
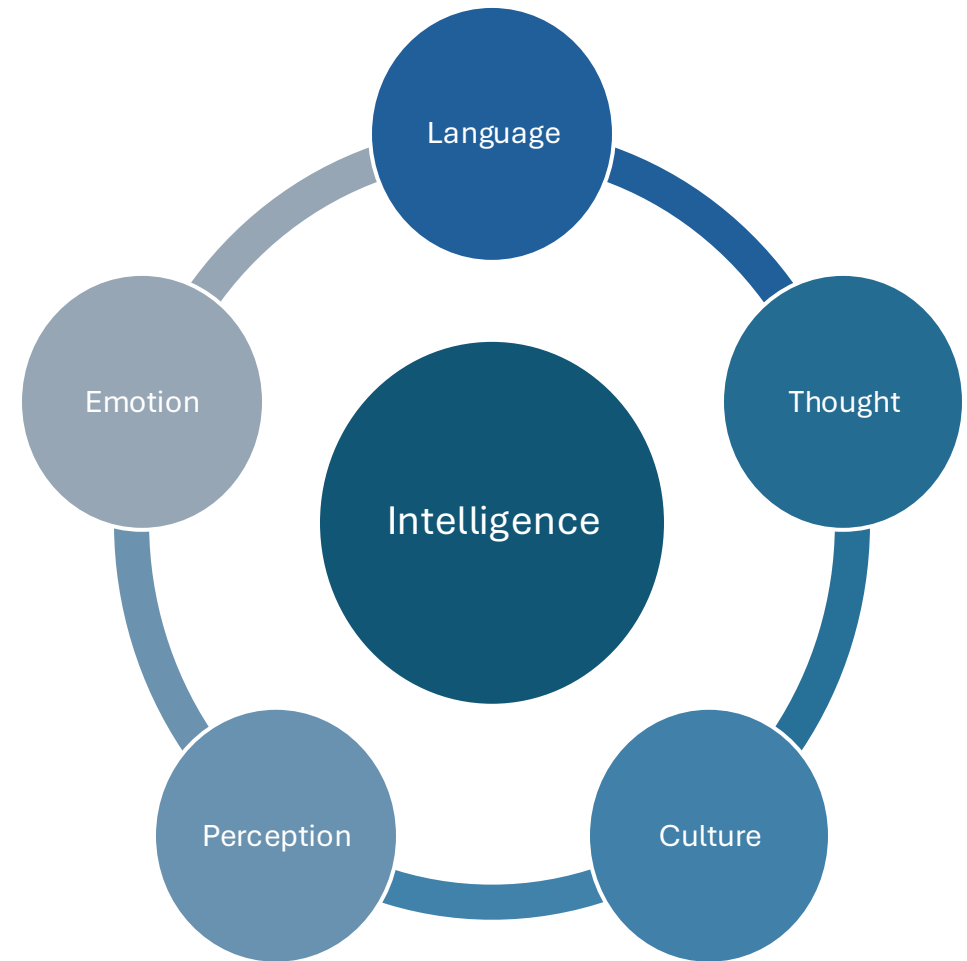## Trends, Challenges, and Opportunities

By

Mona Soliman Habib
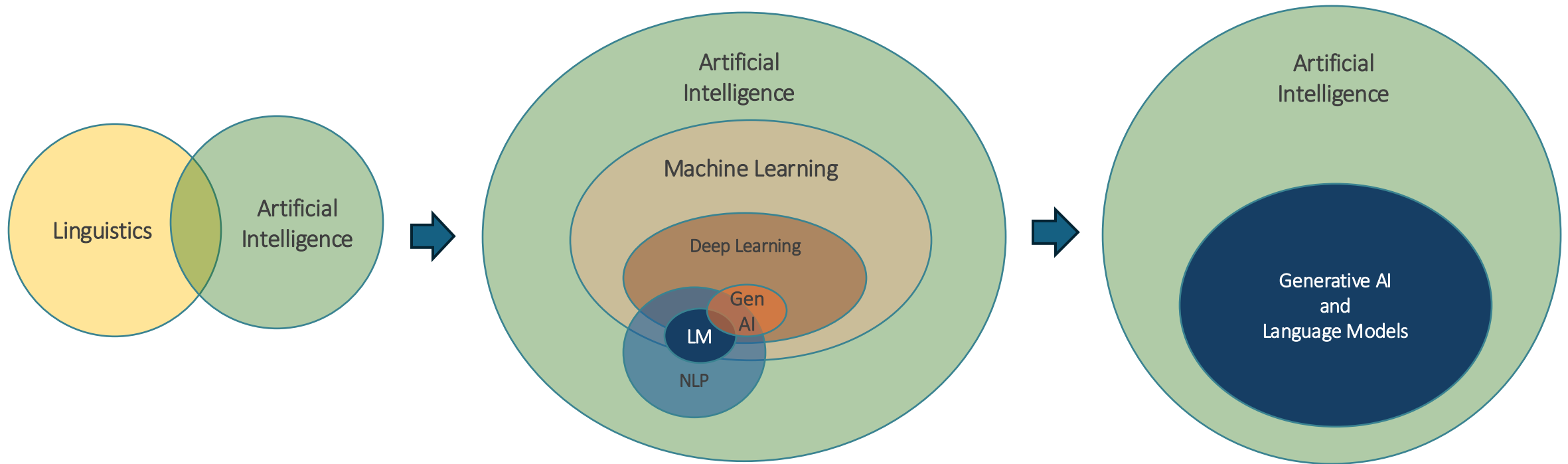
Partner Data & Applied Scientist, Microsoft

February 2025

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What is Language-Driven AI?

- **Human Intelligence** is deeply intertwined with language, culture, perception, and emotion.

- **Language-driven AI** uses language to process and generate information, simulating aspects of human intelligence like communication, reasoning, problem-solving, and decision-making.
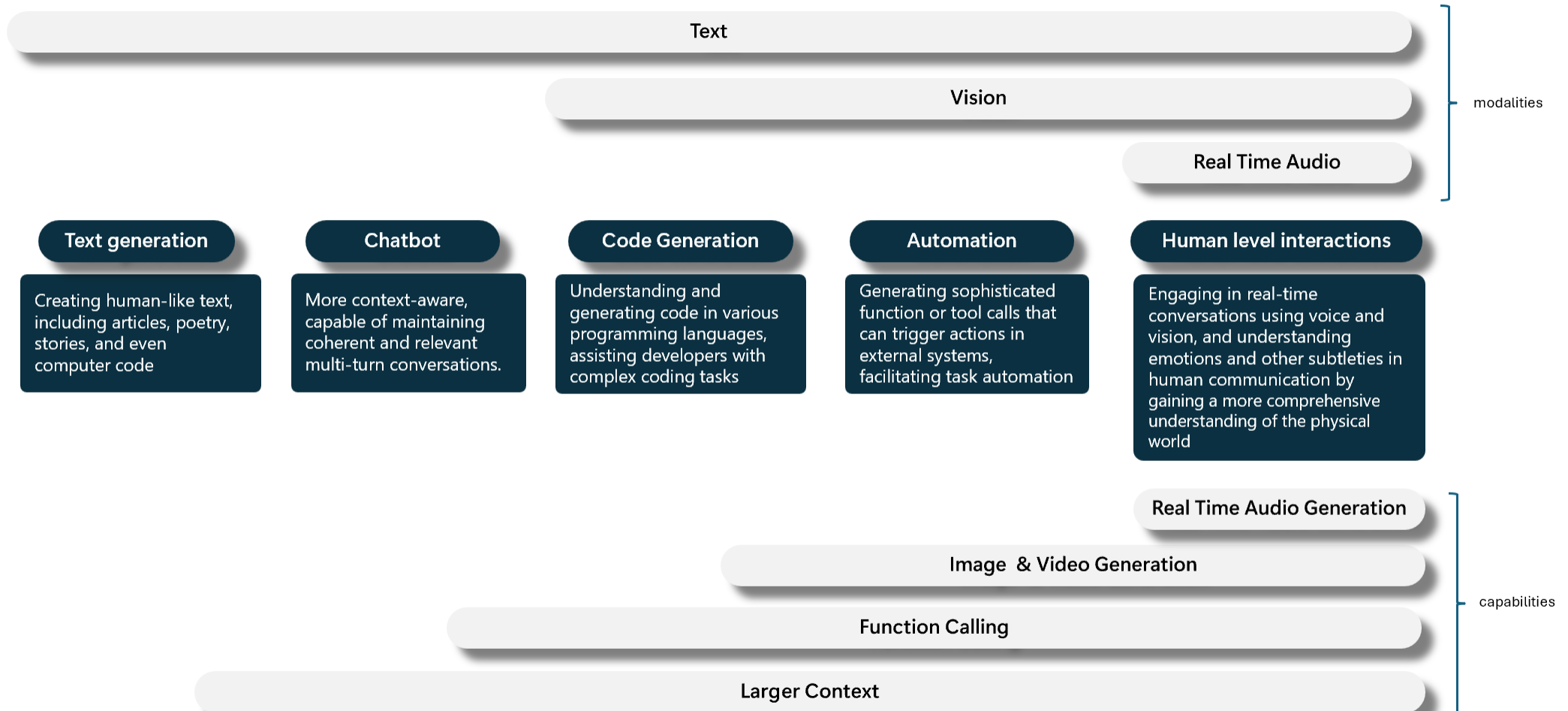
Language

Thought

Emotion

Intelligence

Perception

Culture

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The (Large) Language Models Era

Evolution of Natural Language Processing and Understanding

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Rapid Advancements of Generative AI

Text

Vision

Real Time Audio

modalities

Text generation

Creating human-like text, including articles, poetry, stories, and even computer code

Chatbot

More context-aware, capable of maintaining coherent and relevant multi-turn conversations.

Code Generation

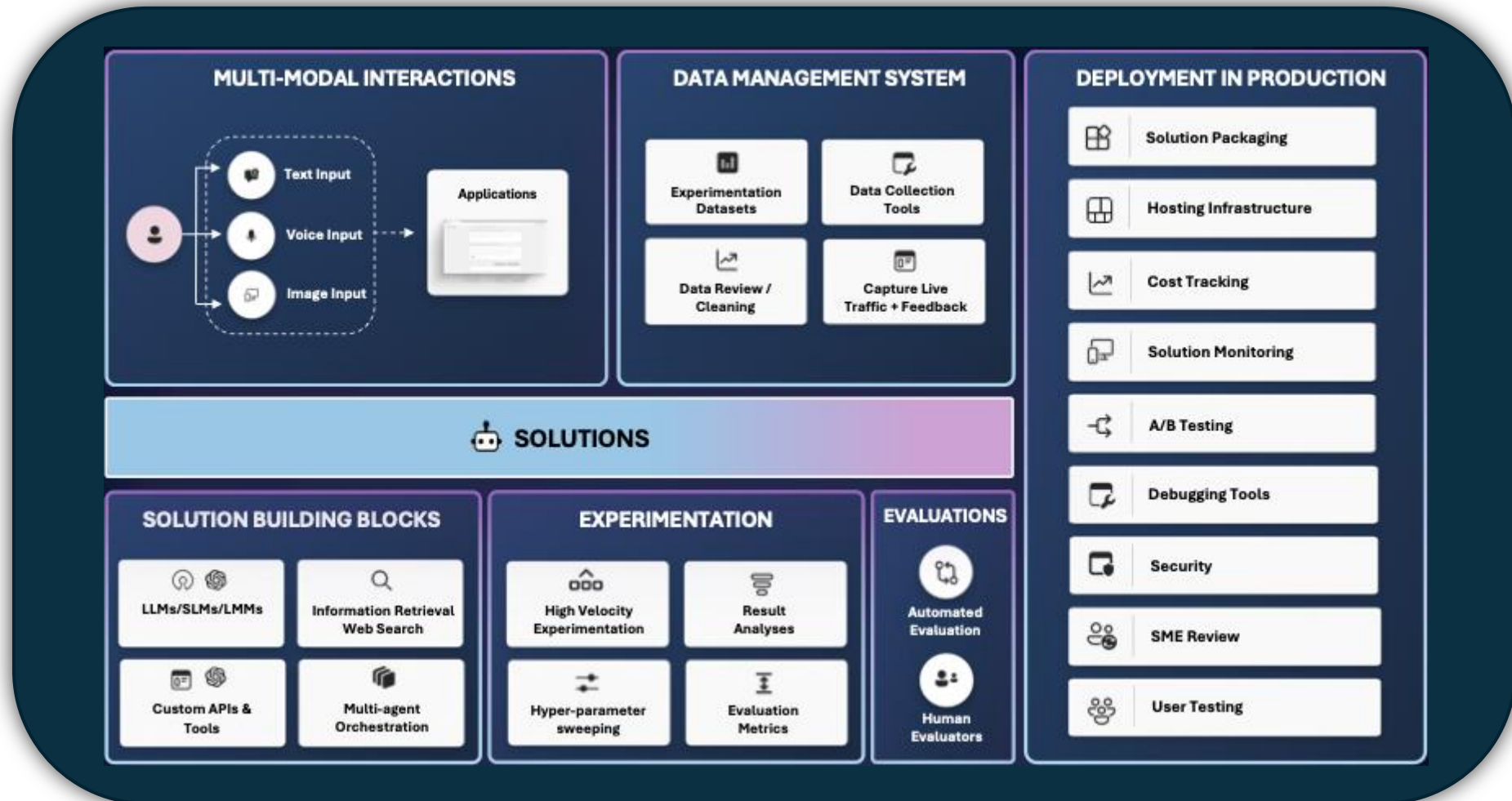Understanding and generating code in various programming languages, assisting developers with complex coding tasks

Automation

Generating sophisticated function or tool calls that can trigger actions in external systems, facilitating task automation

Human level interactions

Engaging in real-time conversations using voice and vision, and understanding emotions and other subtleties in human communication by gaining a more comprehensive understanding of the physical world

Real Time Audio Generation

Image & Video Generation

Function Calling

Larger Context

capabilities

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From Hype to Solving Real World Problems
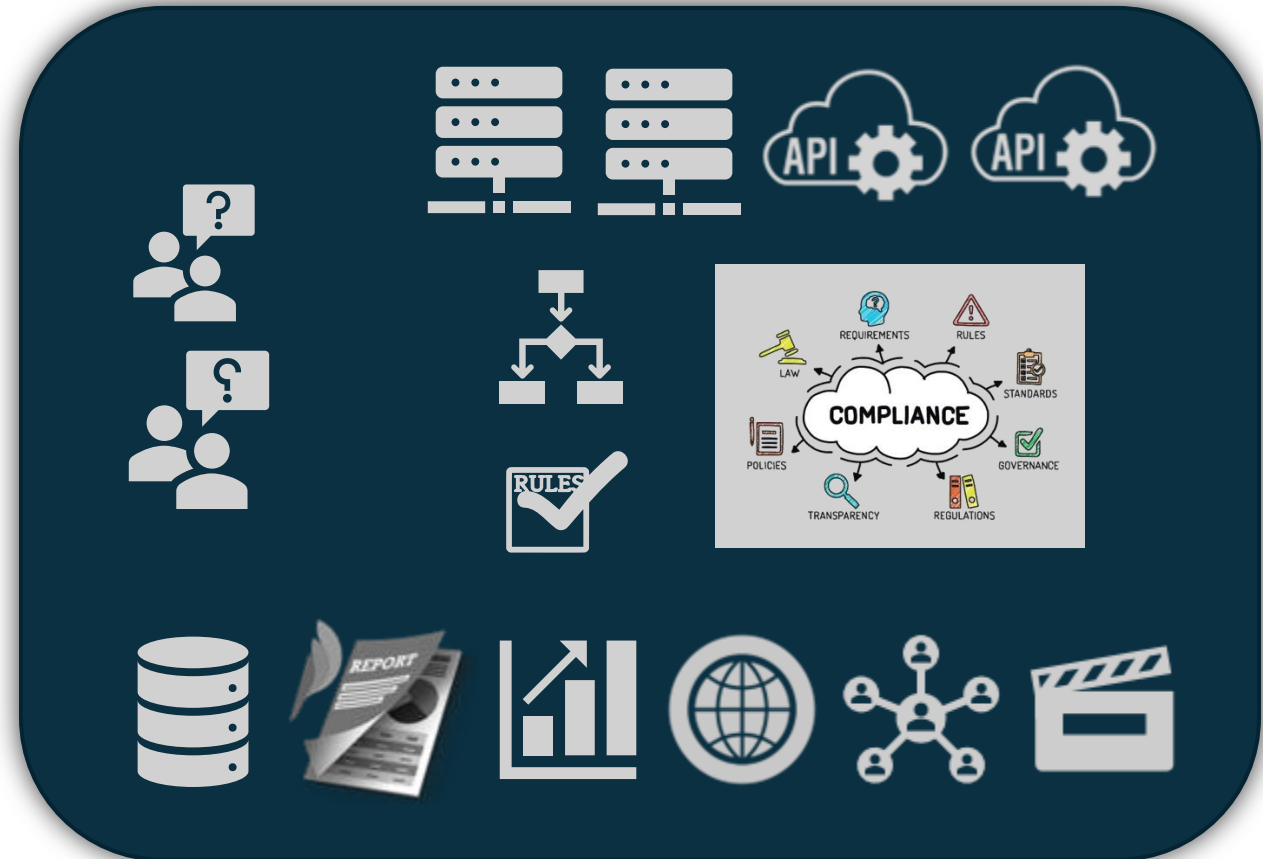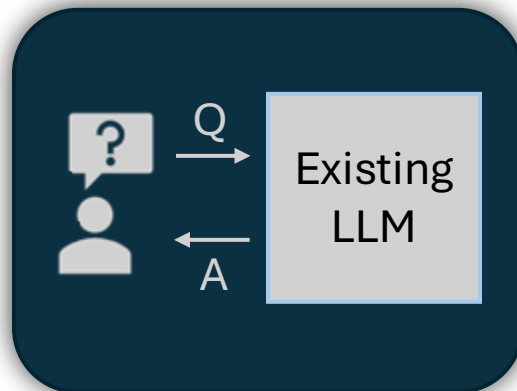
It Takes More Than Models

Frameworks and Tools Are Constantly Evolving

	AWS	Azure	Google	Third-Party	Open-Source
FMOps					
Foundation Model	Anthropic, AI21 labs, Cohere, Meta, Mistral, Stability AI	GPT-4, GPT-4o, OpenAI o1, Cohere, Meta, Mistral	Gemini, Gemma, Anthropic, Meta, Mistral	Hugging Face Transformers	BLOOM
Model Deployment	Amazon SageMaker, Amazon Bedrock	Azure ML	Vertex AI	LangChain	TensorFlow
Fine-Tuning	Amazon SageMaker, Amazon Bedrock	Azure OpenAI	Vertex AI	Mosaic	Stability AI
Low-Code Development	Amazon SageMaker Canvas, AWS App Studio	Power Apps	Gen App Builder	Dataiku	Budibase
Vector Database	Amazon OpenSearch/Aurora/RDS/DocumentDB, Vector Search for Amazon MemoryDB	Cosmos DB	Cloud SQL	Pinecone	Milvus
Code Completion	Amazon Q Developer	GitHub Copilot	Duet AI	Tabnine	Jedi
MLOps					
ML Platform	Amazon SageMaker	Azure ML	Vertex AI	DataRobot	Kubeflow
Bot	Amazon Q Business, Amazon Lex	Microsoft Bot Framework	Dialogflow	Chatfuel	Botpress
Speech	Amazon Polly, Amazon Transcribe	Azure AI Speech	Speech-to-Text/Text-to-Speech	Verint	SpeechBrain
Video	Amazon Rekognition Video	Video Indexer	Video AI	Final Cut Pro	OpenCV
NLP	Amazon Comprehend	Text Analytics	Natural Language AI	Sentiment Analysis	Natural Language Toolkit
Translation	Amazon Translate	Translator	Translation AI	DeepL Translate	OpenNMT
DataOps					
Relational Database	Amazon RDS	SQL Database	Cloud SQL	Snowflake	PostgreSQL
NoSQL	Amazon DynamoDB	Cosmos DB	Firestore, Bigtable	MongoDB	Apache Cassandra
Caching	Amazon RDS, DynamoDB, MongoDB, Apache Cassandra	Cache for Redis	Memorystore	Redis	Memcached
Big Data	Amazon EMR	Data Lake Storage	Dataproc	Databricks	Apache Hadoop
Data Integration	AWS Glue	Synapse Studio	Cloud Data Fusion	Informatica	Apache Camel

The tools presented are illustrative examples and do not represent a comprehensive list.

Source: AI Trends 2025 | Info-Tech Research Group

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Complex Solution
≠
Best Solution

Image created by Microsoft Designer
"a super complex multi-function kitchen machine on a small countertop"

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Practical Lessons Learned

Business Value

Focus on problems with high ROI.

End Users

Understand problems and scenarios from end user perspectives.
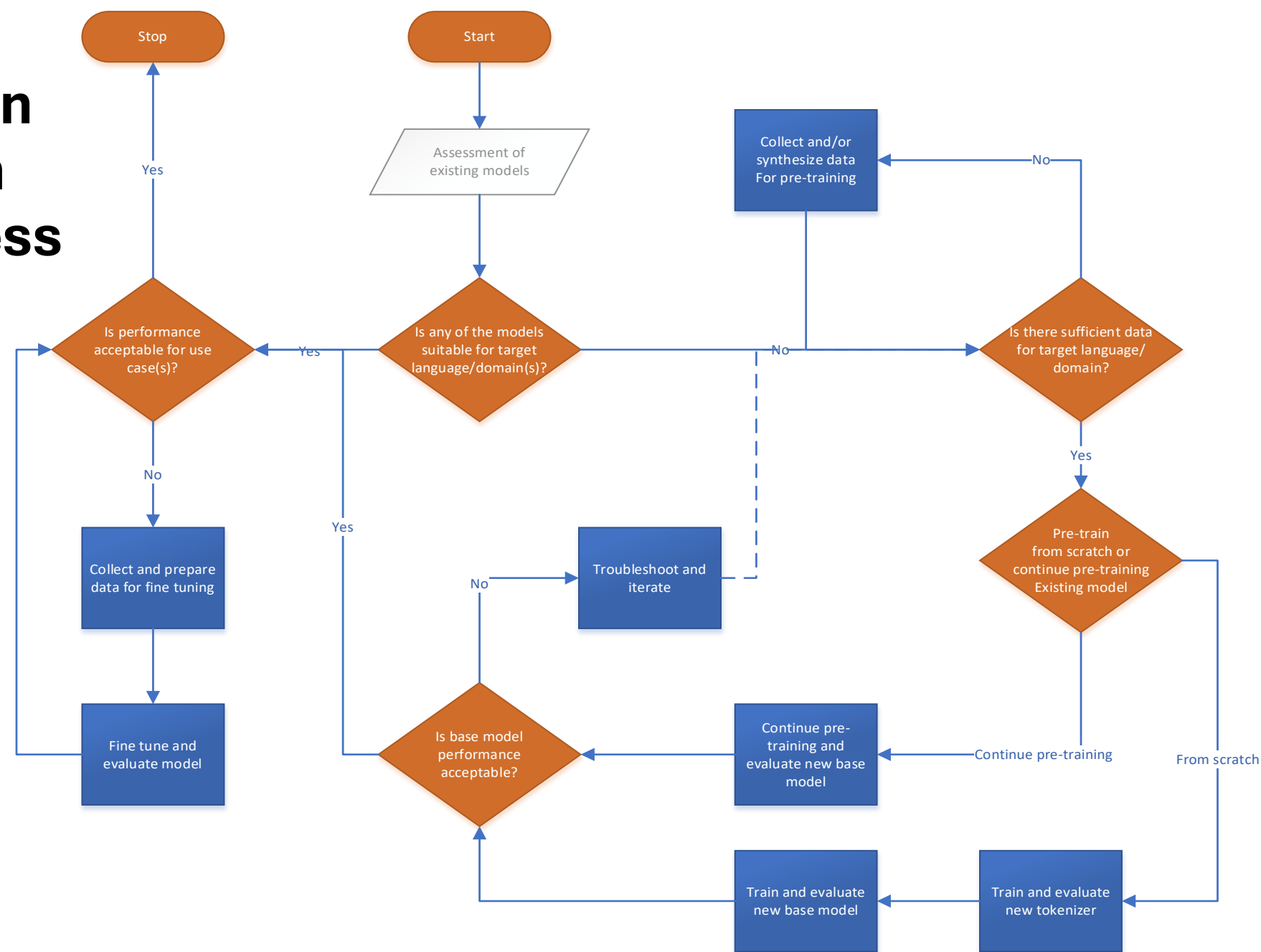
(e.g. Design Thinking)

Fundamentals

- Experiments
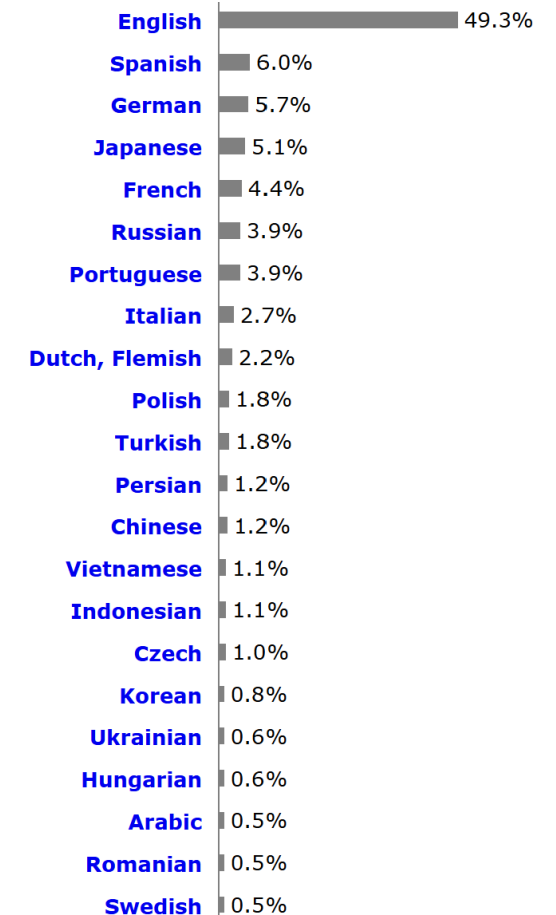- Evaluation
- Observability
- Security
- Responsible AI

Real Data

There is no replacement for *a lot* of real examples.

Model Selection and Adaptation Decision Process

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Data is the Secret Sauce!

- Models are trained with publicly available data, but how representative is it?

- Arabic web content ≈ 0.5% - 1%!

- High engagement in social media → lower quality

- Quality Arabic data availability is crucial for:
  - Language and cultural coverage in models
  - Fair and responsible representation
  - Training **and** reliable benchmarks
  - Bootstrapping vertical domain knowledge
  - Cross-lingual knowledge transfer from highly representative language(s) such as English and French

Language	Percentage
English	49.3%
Spanish	6.0%
German	5.7%
Japanese	5.1%
French	4.4%
Russian	3.9%
Portuguese	3.9%
Italian	2.7%
Dutch, Flemish	2.2%
Polish	1.8%
Turkish	1.8%
Persian	1.2%
Chinese	1.2%
Vietnamese	1.1%
Indonesian	1.1%
Czech	1.0%
Korean	0.8%
Ukrainian	0.6%
Hungarian	0.6%
Arabic	0.5%
Romanian	0.5%
Swedish	0.5%

Source: Usage Statistics and Market Share of Content Languages for Websites, February 2025

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AI Acceleration for the Arab Region

Vertical and Proprietary Specialization

- Leverage foundational models and OSS
- Secure and private data, target domains and use cases
- Healthy research competition

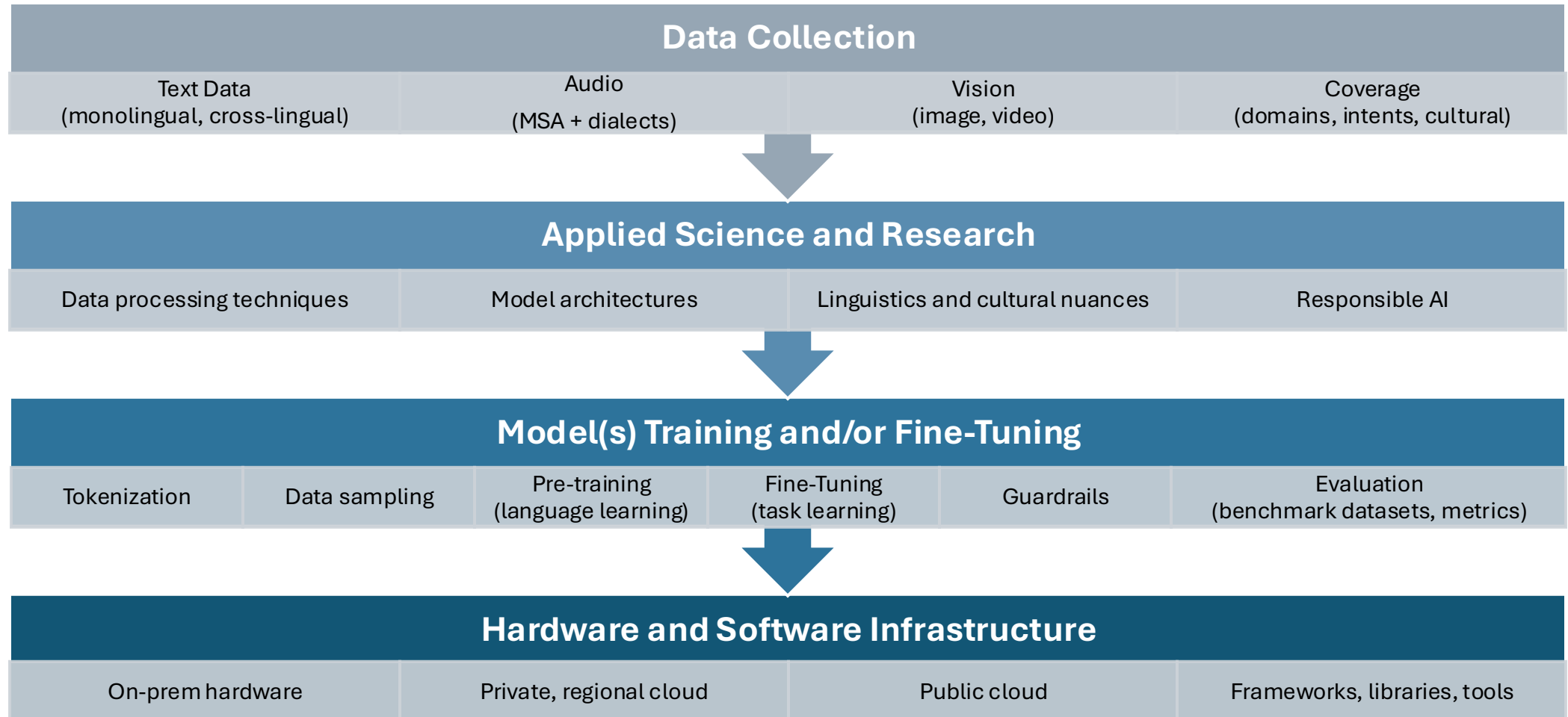## Regional Open-Source (OSS) Initiatives

- Shared libraries, frameworks, tools
- Guardrail models for Responsible AI

Foundational (Public, Shared)

- Regional collaboration for data collection and management
- Pooled infrastructure for R&D
- Multimodal foundational (Large/Medium/Small) models for Arabic language and cultural understanding + core knowledge from highly represented language(s)

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Foundational Models for the Arab Region

Data Collection

Text Data (monolingual, cross-lingual)	Audio (MSA + dialects)	Vision (image, video)	Coverage (domains, intents, cultural)

Applied Science and Research

Data processing techniques	Model architectures	Linguistics and cultural nuances	Responsible AI

Model(s) Training and/or Fine-Tuning

Tokenization	Data sampling	Pre-training (language learning)	Fine-Tuning (task learning)	Guardrails	Evaluation (benchmark datasets, metrics)

Hardware and Software Infrastructure

On-prem hardware	Private, regional cloud	Public cloud	Frameworks, libraries, tools

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Consequences of Generative AI for Information Access

Information ecosystem disruption

Significantly changing how different actors and stakeholders in the online information ecosystem operate on their own and how they relate to each other

Concentration of power

Worsening inequities in how power and control are distributed within our society and different communities

Marginalization

Relegating certain individuals and groups to the margins of society and corresponding discrimination

Innovation decay

Constraining scientific explorations to specific narrow directions while throttling progress in other areas of information access research

Ecological impact

Worsening anthropogenic climate change

Mitra, Cramer, & Gurevich. Sociotechnical implications of generative artificial intelligence for information access. Preprint of chapter for an upcoming edited book, 2024.

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Thank You!