Data concerns and considerations

LARGE LANGUAGE MODELS (LLMS) CONCEPTS

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Data considerations

- Data volume and compute power
- Data quality
- Labeling
- Bias
- Privacy

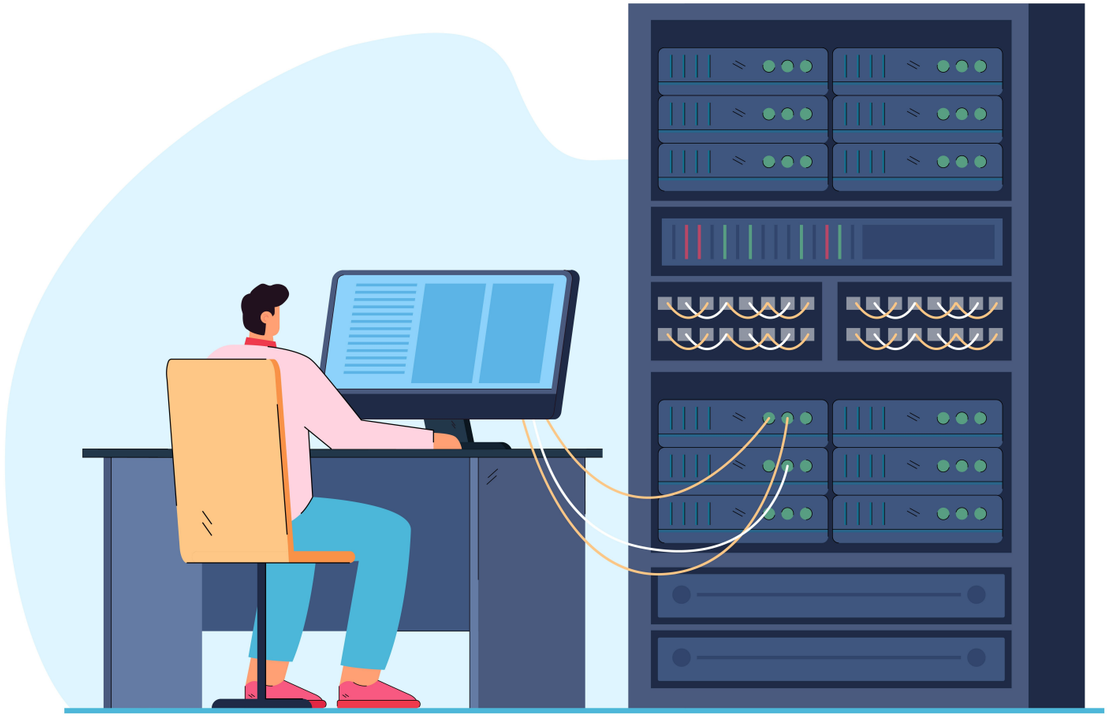
Data volume and compute power

- LLMs need a lot of data
  - Similar to a child learning to talk
  - 570 GB, ~1.3 million books

[1] Freepik

Data volume and compute power

- LLMs need a lot of data
  - Similar to a child learning to talk
  - 570 GB, ~1.3 million books
- Extensive computing power; think of the energy consumption
- Can cost millions of dollars!

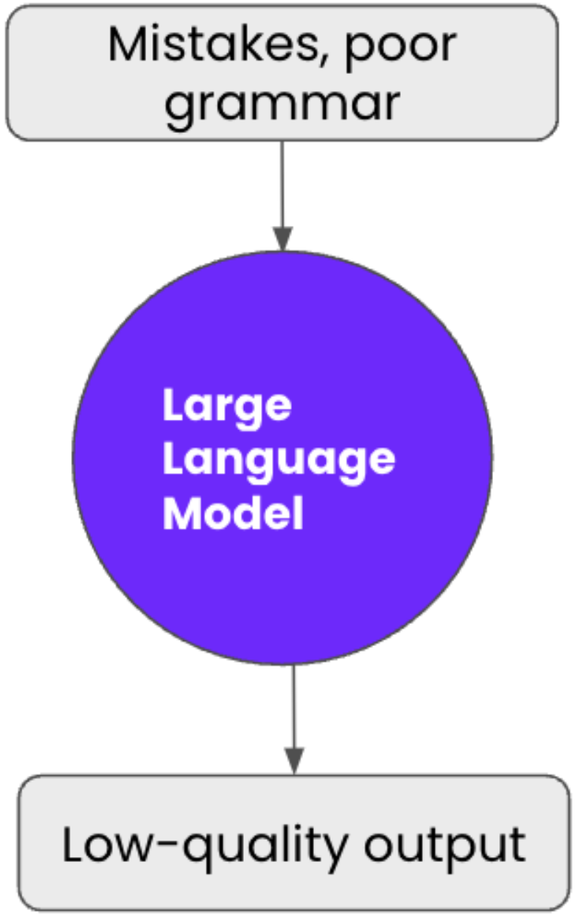


Data quality

- Quality data is essential

- Accurate data = better learning = improved response quality = increased trust

- A child learning to talk
  - Gibberish-in -> gibberish-out



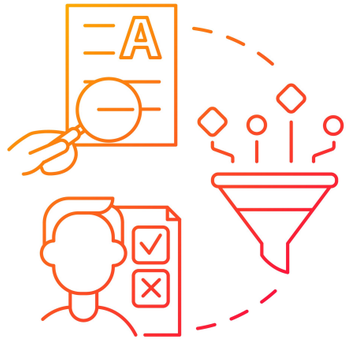
Labeled data

- Correct data label: accurate learning, generalize patterns, accurate responses
- Labor-intensive: assigning correct label to each article

- Incorrect labels impact model performance
- Address errors: identify -> analyze -> iterate

Data bias

- Influenced by societal stereotypes
- Lack of diversity in training data
- Discrimination and unfair outcomes



BIAS

- Spot and deal with the biased data
  - Evaluate data imbalances
  - Promote diversity
  - Bias mitigation techniques: more diverse examples

- Example:
  - "The nurse said that..." -> "she" or "her"

Data privacy

- Compliance with data protection and privacy regulations
- Sensitive or personally identifiable information (PII)
- Privacy is a concern
  - Training on data without permission can lead to a breach
  - Legal, financial and reputational harm
- Get permission

Let's practice!

LARGE LANGUAGE MODELS (LLMS) CONCEPTS

Ethical and environmental concerns

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Ethical concerns

- Transparency risk
-
-

Ethical concerns

- Transparency risk
- Accountability risk -

Ethical concerns

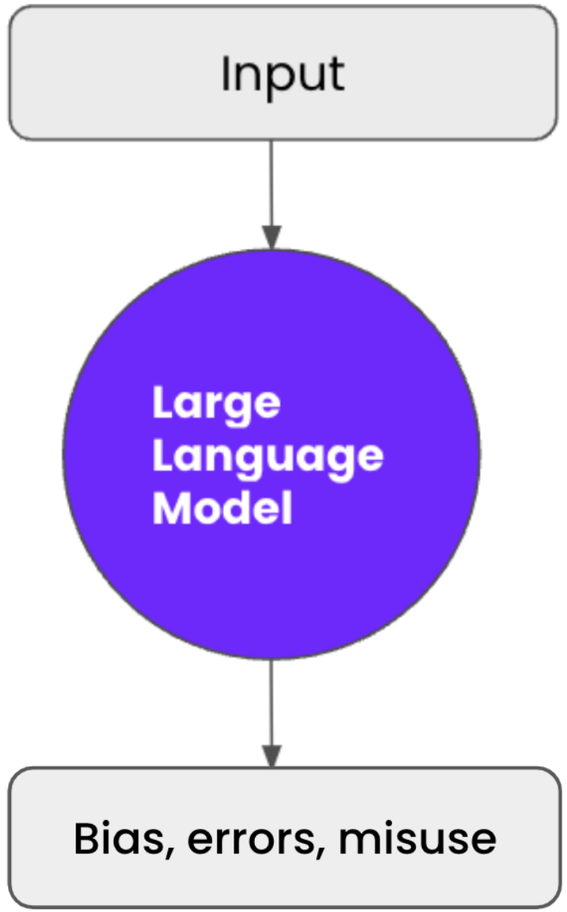
- Transparency risk
- Accountability risk
- Information hazards

Transparency risk

- Challenging to understand the output

- Difficult to identify issues
  - Bias
  - Errors
  - Misuse
- Black box

- Example: reasoning behind predicting disease outcomes



Accountability risk

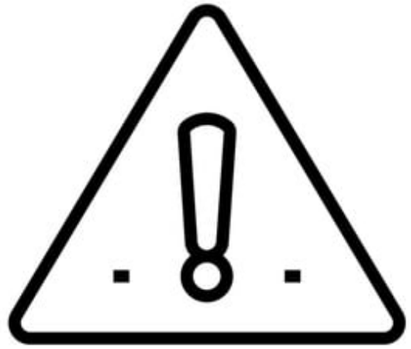
- Responsibility of LLMs' actions

- Who is responsible?
  - Incorrect and harmful advice
  - Model developer or the company?

- Game without rules
  - No transparency
  - No accountability

[1] Freepik

Information hazards



Disseminating harmful information

- Harmful content generation
- Misinformation spread
- Malicious use
- Toxicity

Information hazards

Harmful content generation

- Harmful, offensive, or inappropriate
- Prompt or biased training data
- Example:
  - Bullying vs. friendly school environment
  - Distressing and harmful

Misinformation spread

- Generate text on any topic
- But, no verification!
- Example:
  - "What's a good diet for losing weight?"
  - Unsubstantiated diet plan

Information hazards

Malicious use

- Bad actors exploiting LLMs
- Generate deceptive content
- Example:
  - Fabricated news
  - Manipulating public and causing unrest

Toxicity

- Inappropriate content
- Training or through manipulated prompts
- Example:
  - Insensitive response
  - Stereotype

Environmental concerns

- Ecological footprint of LLMs
- Substantial energy resources to train
- Impact through carbon emissions

[1] Freepik

Cooling requires electricity too!

- Produce considerable heat that needs cooling

- Imagine thousands of laptops overheating
  - Require complex cooling systems
  - Adds to environmental impact

- Balance the cost and benefits
  - Use renewable energy
  - Energy-efficient tech

[1] Freepik

Let's practice!

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Where are LLMs heading?

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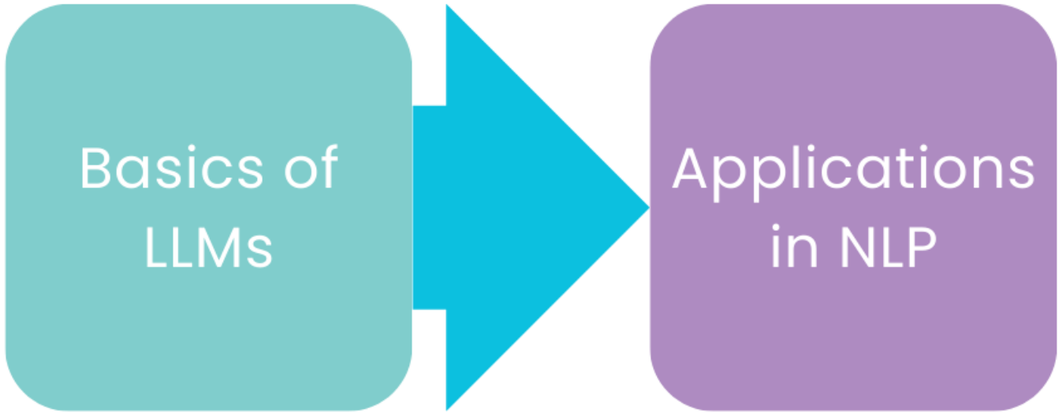
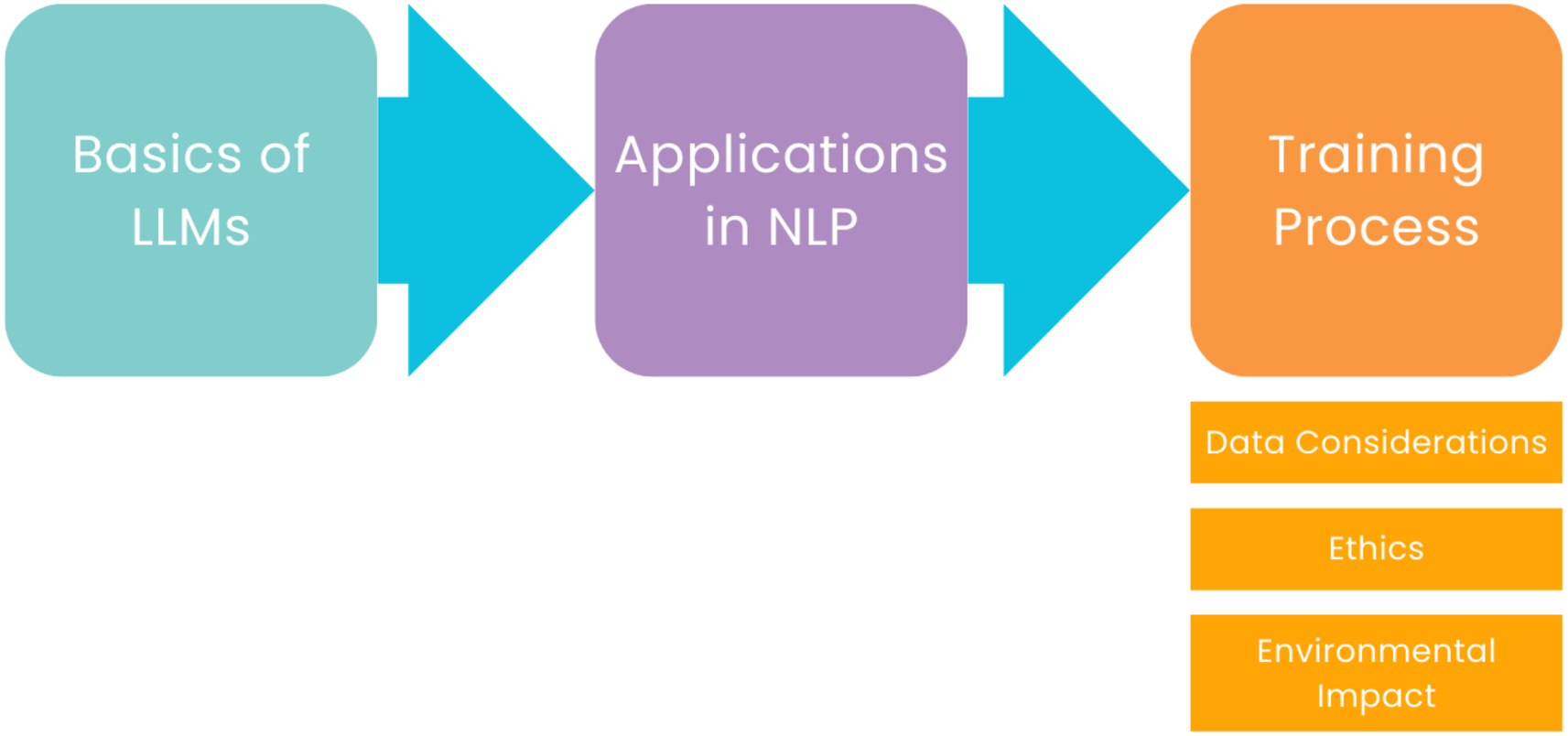
Journey so far

Basics of LLMs

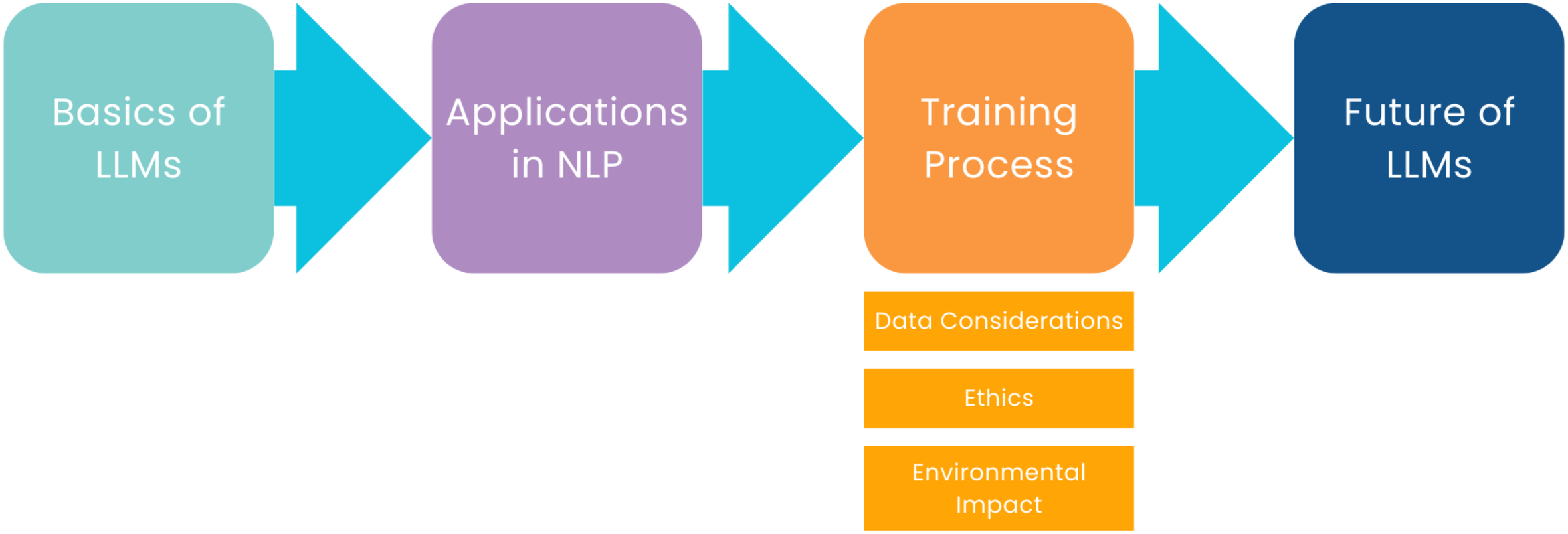
Journey so far



Journey so far



Journey so far



Model explainability

- How do they arrive at their outputs?

- Road-trip planning
  - Why this particular route?
  - Why these specific spots?

- Builds trust and transparency
- Identify and correct the biases or errors

[1] Freepik

Efficiency

- **Computational efficiency**
  - High-quality output with less compute
- **Faster and efficient**
  - Model compression
  - Optimization
- **Benefits:** better storage, lower energy use
- **Accessibility and sustainability**
  - Promotes green AI
  - Reduces operating costs

[1] Freepik

Unsupervised bias handling

- Biased data -> discrimination
- **Unsupervised bias handling**
  - Bias detection and mitigation techniques, automatically
  - No need of explicit human-labeled data
  - Identifies and reduces by analyzing patterns
- **Challenge**
  - Subtle, difficult to detect
  - Might introduce new biases

Enhanced creativity

- Creativity in text-based and visual art forms
- **Artistic content:** learned patterns, not emotional understanding
- Lack human-like comprehension of art or emotions
- Demonstrate human-like emotional behavior
- **Future:** emotion inference

[1] https://arxiv.org/pdf/2302.09582.pdf

Let's practice!

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Time to wrap-up

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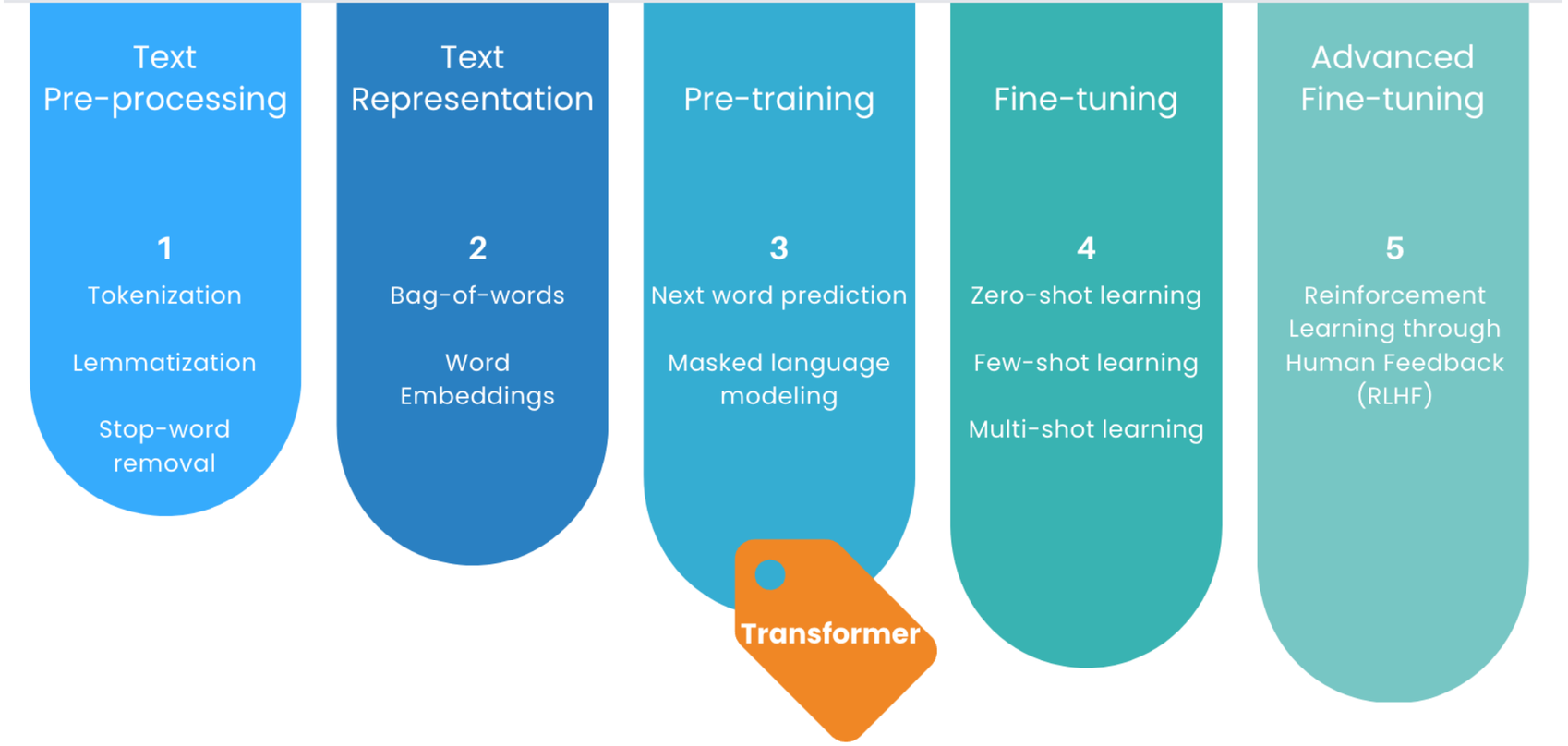
How far we have come!

LLMs transforming interaction with technology



How far we have come!

- Substantial data requirements
- Challenges and risks - privacy, ethics, and environmental implications
- Future research and development

There is more to it

- Entire teams devoted to understanding LLMs
- Exciting times ahead
- Stay updated with the latest developments
  - **More on data ethics**
  - **Introduction to ChatGPT**

Congratulations!

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