Foundations of AI Agents

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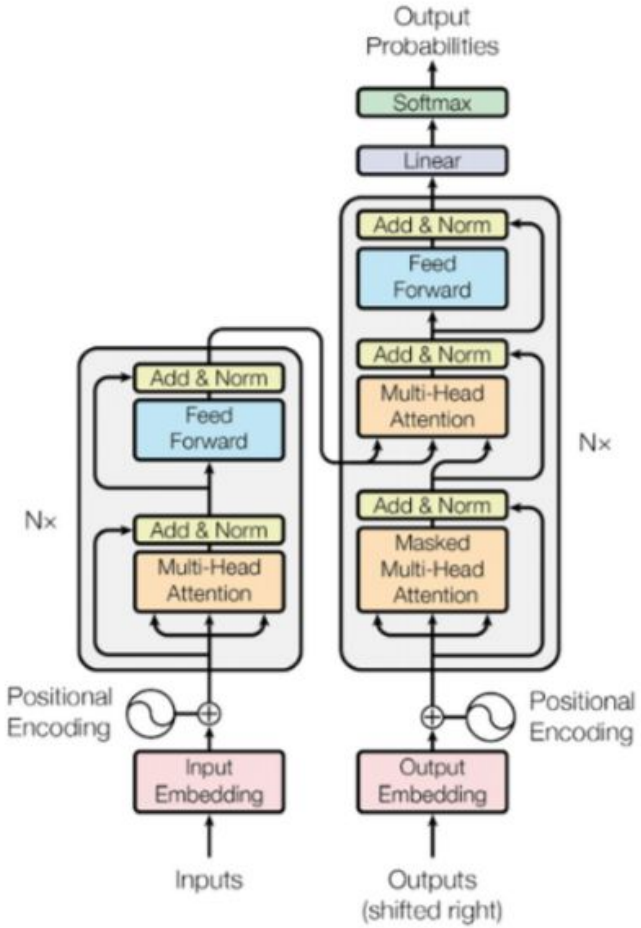
Attention Is All You Need (2017)

Transformer

Attention Is All You Need



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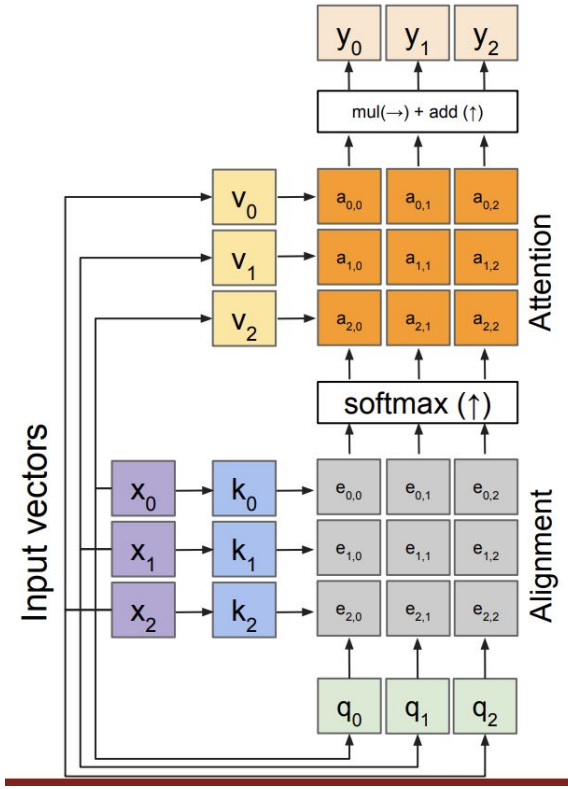
Demystifying Attention

Self attention layer



Outputs:
context vectors: **y** (shape: D_v)

Operations:
Key vectors: $\mathbf{k} = \mathbf{x}W_k$
Value vectors: $\mathbf{v} = \mathbf{x}W_v$
Query vectors: $\mathbf{q} = \mathbf{x}W_q$
Alignment: $e_{i,j} = q_j \cdot k_i / \sqrt{D}$
Attention: $\mathbf{a} = \text{softmax}(\mathbf{e})$
Output: $y_j = \sum_i a_{i,j} v_i$

Inputs:
Input vectors: **x** (shape: N x D)

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LMs Are Few Shot Learners (2020)

- Paper showed that LLMs were able to do things without explicit training
  - Translation to different languages by getting fed instructions on how another language worked
- In Context Learning
  - LLMs are able to “learn” new things with no “re-training”
  - Implication → LLMs can “generalize”
- What does this mean?
- How can we harness this power?

Vision Transformers (2020)

- Idea of Transformers was applied to images
- Paper showed that ViT was SOTA for vision tasks
- Transformer was shown to have “multi-modal” capabilities
- What does this mean?
- What are the implications of this?

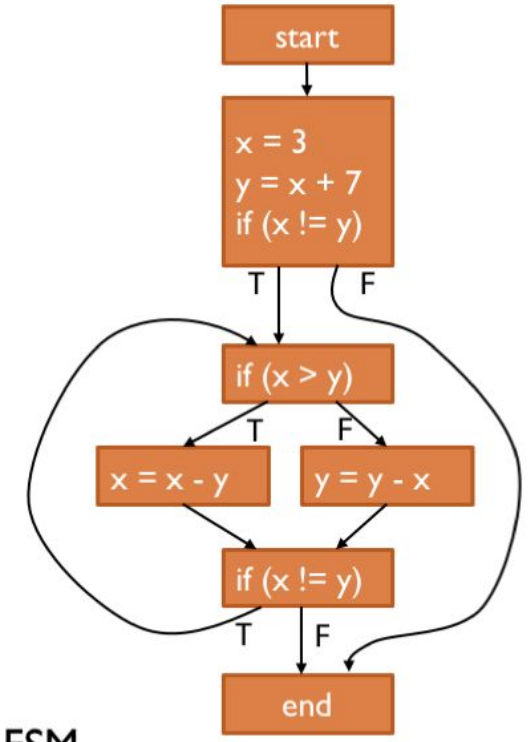
Retrieval-Augment Gen (2020)

- Problem → Knowledge of Transformers are fixed to data from training (also called Knowledge Cutoff)
- Solution → Feed relevant information to AI when a question is asked.
- This became SOTA for knowledge-intensive tasks

Control Flow of a Program

Control Flow Graph for GCD

```
int x = 3;
int y = x + 7;
while (x != y) {
  if (x > y) {
    x = x - y;
  } else {
    y = y - x;
  }
}
```



Looks like a high-level FSM…

Agentic AI (2026 and beyond)

- Agentic AI → Artificial Intelligence system capable of doing “things”
- Example of Agentic AI
  - Claude Code → Interacts with code, execute shell commands, etc
- AI Agents = LLM + Specialized Prompt + Environment + Control Flow
- What makes Agentic AI possible?

Thank You!

Next Time: Agentic AI through OpenClaw Case Study

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