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# Here comes DeepSeek

The Next Big Leap in AI Reasoning



Yogesh Haribhau Kulkarni (PhD)

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$x^2 - 5x + 6 = 0$

?? (?) !!

$x = 2$

$x = 3$

"AHA!"

# DEEPESEEK

What's 'new' / diff wrt 'current' models

deepseek. com

- Open-Source. Wts also 🌟
- MIT License (Commercial)

Long chain of Thoughts (CoT)  
Mixture of Experts (MoE)

typical 'current' models	DeepSeek 'new' model
PPO (Proximal Policy optimization) DPO (Direct Preference optimization) Critic network heavy	GRPO (Group Relative Policy optimization) Group comparisons are efficient
FP32	FP8
Sign Exp fraction ↑ more memory more precise	Sign ↓ low memory ↓ Numerical stability
Prediction word by word SLOW, heavy on computation	Prediction by group 1 → n Coherent blocks together.

Query

Router

chooses submodel for Query  
∴ Only 37B params active  
for tokening" for 600B model  
≈ 80% Computational Saving

Multihead Latent Attention (MLA)

Key → projected  
Query → compressed  
Value → Reuse & smaller memory

COLD START

V3-Base + SFT on Few shots

R1 zero Reasoning data

SFT Check Point

RL

DeepSeek R1 (main)

Smaller models  
LLama...  
Qwen...  
Distill'n Teacher-student

Reflection  
Self-Correction  
'Aha' Emergence

References

- Original Paper
- Jay Alammar Guid
- Vinija's Notes

(Sketchnote by the Author himself)

Just like the ChatGPT moment of November 2022, another big disruption has arrived

👉 Deepseek-R1! This isn't much about a fundamentally new architecture but rather computational efficiency, clever optimizations, and significant cost savings.💡⚡

**DeepSeek** is an open-source, MIT-licensed AI model that prioritizes **reasoning** over mere word completion. Unlike traditional models that predict the next word based on statistical probabilities, DeepSeek introduces **smarter decision-making, efficient computation, and enhanced reasoning abilities**.

In this blog, we'll dive into what sets DeepSeek apart, how it redefines AI optimization, and why it might be the most impactful advancement in language modeling today.

### How DeepSeek Changes the Game

- **New Optimization Techniques:** Most AI models today rely on **PPO (Proximal Policy Optimization)** or **DPO (Direct Preference Optimization)** for reinforcement learning. DeepSeek, however, introduces a **new optimization strategy — GRPO (Group Relative Policy Optimization)**. This approach refines AI decision-making by improving efficiency and learning through comparative ranking rather than absolute rewards.
- **A Shift Away from Supervised Fine-Tuning (SFT):** Older models heavily rely on **Supervised Fine-Tuning (SFT)** to improve accuracy. DeepSeek takes a different route by **minimizing reliance on SFT**, allowing the model to learn in a more dynamic and flexible manner through reinforcement learning.
- **Parallel Decoding: Predicting More Than One Token at a Time:** Traditional models generate text **one word at a time**, which can slow down inference, especially for complex reasoning tasks. DeepSeek changes this by employing **Parallel Decoding** — predicting multiple tokens simultaneously. This means: Faster generation speed, Improved coherence in responses, The ability to generate entire **function definitions, query blocks, and reasoning steps** in one go. By ranking rule-based outputs based on confidence levels, DeepSeek ensures high-quality responses, making it more reliable in long-context tasks.
- **Efficient Memory Usage with FP8 Quantization:** Another key improvement is **FP8 (Floating Point 8-bit) quantization**, which significantly reduces memory consumption — **by 75% compared to FP32** — without sacrificing numerical

stability. This makes DeepSeek far more efficient in handling large datasets and computations.

### Unique Features That Set DeepSeek Apart

- **Long Chain-of-Thought (CoT) Reasoning:** DeepSeek is designed for more than just quick answers — it engages in deeper, more structured reasoning. By maintaining an extended Chain-of-Thought, it effectively handles multi-step problem-solving scenarios.
- **Mixture of Experts (MoE) for Smarter Computation:** DeepSeek incorporates a Mixture of Experts (MoE) approach. This means that instead of activating the full 600B parameter model, it selectively activates only 37B parameters per token — achieving an impressive 80% computational savings. A built-in router directs different tasks to specialized sub-models, ensuring more efficient resource utilization.
- **Multihead Latent Attention (MLA):** This new attention mechanism compresses Key-Query-Value (KQV) matrices into a lower-dimensional latent space. By caching and reusing these projections across tokens, DeepSeek improves both memory efficiency and processing speed.
- **Multi-Token Prediction (MTP):** With MTP, DeepSeek doesn't just guess the next word — it predicts multiple tokens at once. This is particularly valuable for: Code generation (where entire function definitions can be generated in one go), Mathematical problem-solving, Complex logical reasoning tasks, etc.

### The Training Pipeline: How DeepSeek Learns

DeepSeek's training process follows a structured pipeline designed for progressive learning and optimization:

- 1 **Cold Start with Supervised Fine-Tuning (SFT):** The model begins with an initial SFT phase using known high-quality datasets like V3-Base and Chain-of-Thought (CoT) examples from human annotation and other reasoning models (R1-Zero).
- 2 **Reinforcement Learning (RL) for Self-Improvement:** Instead of learning from fixed datasets, DeepSeek evolves through trial and error, refining its responses based on accuracy, format, and logical consistency. GRPO (Group Relative Policy Optimization) helps the model rank outputs and improve dynamically.

**3 Distillation into Smaller Models:** Using a Teacher-Student Paradigm, knowledge from large-scale training is transferred into smaller, more efficient models, maintaining high performance with reduced computational cost.

### DeepSeek's Remarkable Reasoning Patterns

DeepSeek exhibits **human-like reasoning behaviors**, making it **more than just a language model**. Here are a few fascinating ways it improves its own thinking process:

- **Reflection:** It revisits and revises its intermediate steps to ensure accuracy.
- **Self-Correction:** It identifies and fixes errors in real-time.
- **Aha Moments:** The model can pause, reevaluate, and discover new solutions — an ability previously seen only in human problem-solvers.

### Example: Solving a Quadratic Equation

Imagine DeepSeek tackling the equation  $x^2 - 5x + 6 = 0$ .

1. It might first propose incorrect factors.
2. Then, it pauses to reflect on its solution.
3. Finally, it corrects itself, arriving at the correct factors:  $(x - 2)(x - 3) = 0$ , so  $x = 2$  and  $x = 3$ .

This ability to rethink and refine solutions makes DeepSeek far superior to traditional models, which often commit to incorrect answers without reconsideration.

### Final Thoughts: Why DeepSeek Matters

DeepSeek is more than just another AI model — it represents a shift toward smarter, more efficient, and cost-effective AI reasoning. With features like GRPO optimization, Parallel Decoding, MoE routing, and Multihead Latent Attention, it promises better performance while using fewer computational resources.

DeepSeek is paving the way for more intelligent, reliable, and scalable solutions in fields ranging from natural language processing to scientific research and software development. 

### References

## The Illustrated DeepSeek-R1

A recipe for reasoning LLMs

[newsletter.languagemodels.co](https://newsletter.languagemodels.co)

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## Written by Yogesh Haribhau Kulkarni (PhD)

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The screenshot shows a code editor with Dart code. The code handles menu item selection and implements a Dismissible widget. A sidebar on the right provides context and steps for modifying the clip widget.

**Code Snippet:**

```

195     if (menuItem != null) {
196         handleMenuItemSelection(menuItem);
197     }
198 }
199
200 child: Dismissible(
201   key: Key(widget.clipId),
202   background: Container(
203     color: Colors.red,
204     alignment: Alignment.centerRight,
205     padding: EdgeInsets.only(right: 16.0),
206     child: Icon(
207       Icons.delete,
208       color: Colors.white,
209     ), // Icon
210   ), // Container
211   direction: DismissDirection.endToStart,
212   onDismissed: (direction) {
213     clipsModel.deleteClip(clipId: widget.clipId);
214   },
215   child: Container(
216     color: widget.selected
217     ? Theme.of(context).primaryColorLight
218     : null,
219     padding: EdgeInsets.fromLTRB(10, 0, 0, 0),
220     child: Column(
221       children: [
222         Row(mainAxisSize: MainAxisSize.min, children: [

```

**Context and Steps:**

I'll help you add a dismissible widget to make the clip swipeable with a delete action. First, let me check the current implementation of the clip widget.

Analyzed `clip_widget.dart:(1-201)`

I'll modify the clip widget to make it dismissible with a delete action. I'll wrap the main content in a `Dismissible` widget and add a delete icon that appears when swiping. Let me update the file:

Edited `clip_widget.dart +19 -2 284` Open diff

I've made the following changes to the `clip_widget.dart` file:

1. Wrapped the main Container widget with a `Dismissible` widget
2. Added a unique key using the clip's ID
3. Configured the background to show a red container with a white delete icon
4. Set the dismiss direction to `endToStart` (right to left swipe)
5. Added an `onDismissed` callback that calls the existing `deleteClip` method

Now you can:

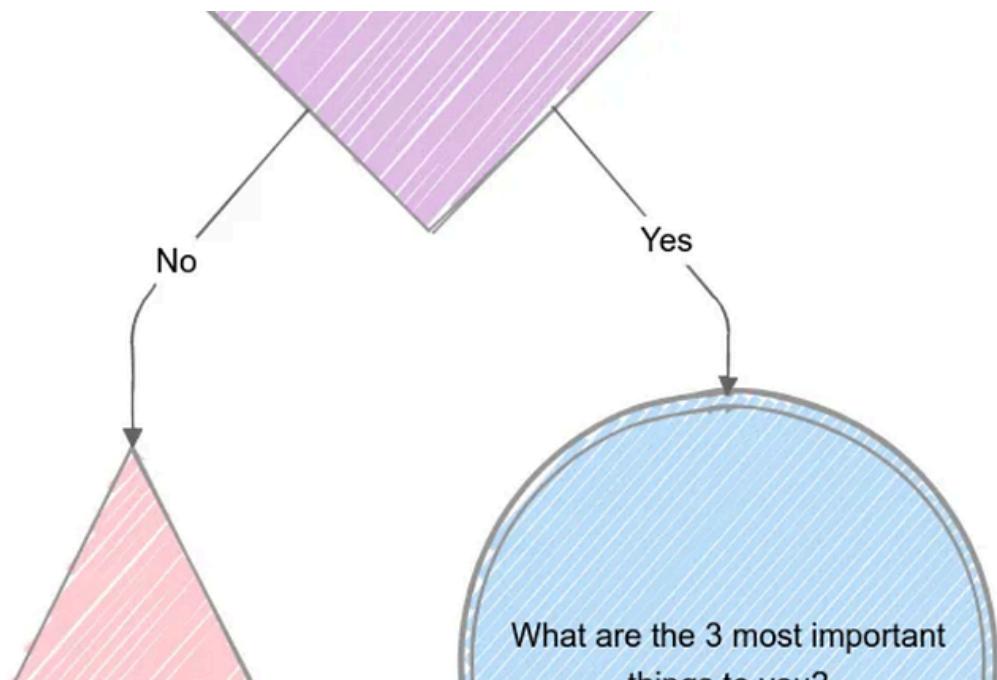
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 Cliff Berg

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...

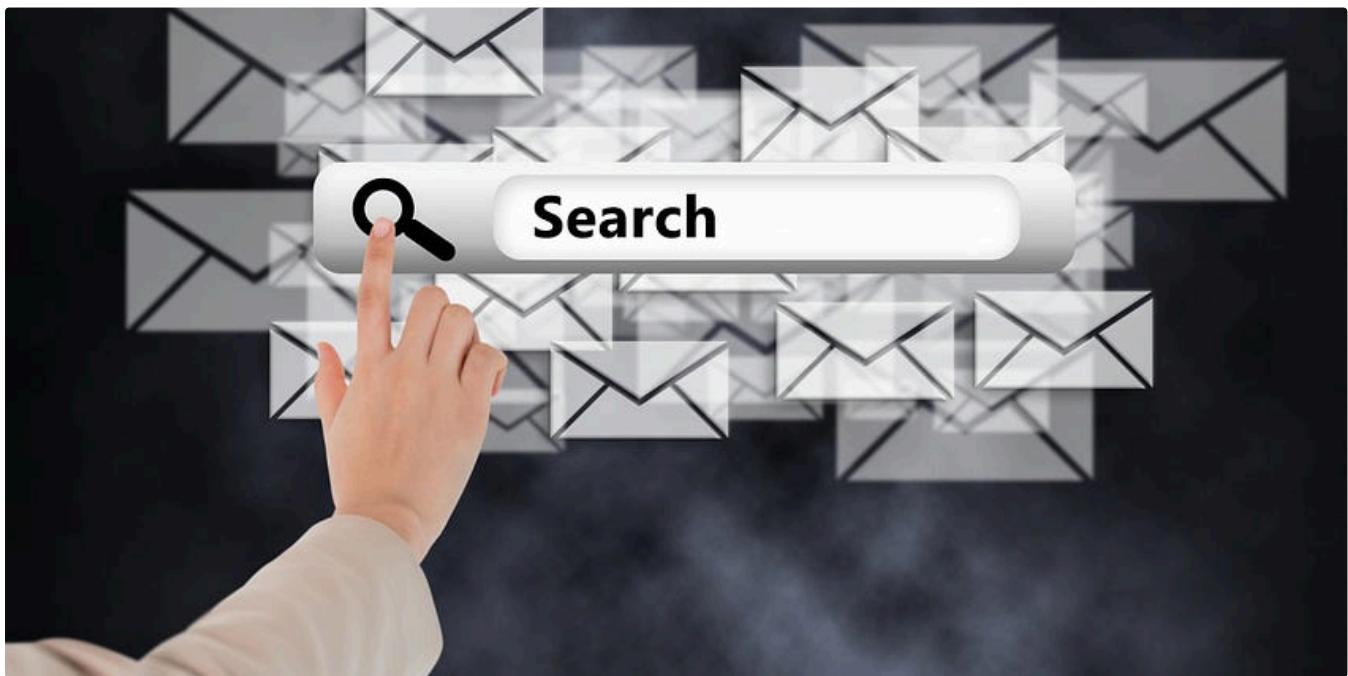
 Jessica Stillman

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