From PhD to Industry:

LLM and Career Path

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Outline

- LLMs
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  - Reasoning (Technical)
  - Optimization (Technical)
  - Positive feedback (Math)
  - Sum up
- Career Path
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  - Guide for PhD Students
  - Job Hunting
  - Interview
  - Sum up

First Part:
LLMs

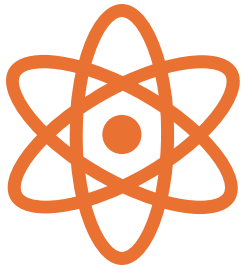
Exploring Infinite Intelligence

Philosophical, Not Scientific
A speculative idea, not grounded in current science.

Current AI is Bounded
Operates within training data — no true creativity.

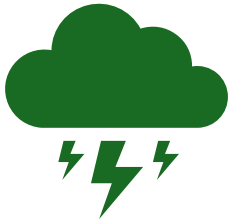
The Singularity Hypothesis
A hypothetical point where AI improves itself exponentially.

Intelligence Might Have a Natural Limit.



1. Physical Limits

Intelligence relies on computation, bound by physics (light speed, energy, thermodynamics).



2. Complexity Collapse

Too much complexity can cause instability or self-destruction.

Beyond a threshold, systems may lose coherence—like fragile ecosystems.

Training LLMs

1. Pre-training (Self-Supervised Learning)

Trained on massive text data by predicting missing or next words.

2. Post-training (Reinforcement Learning)

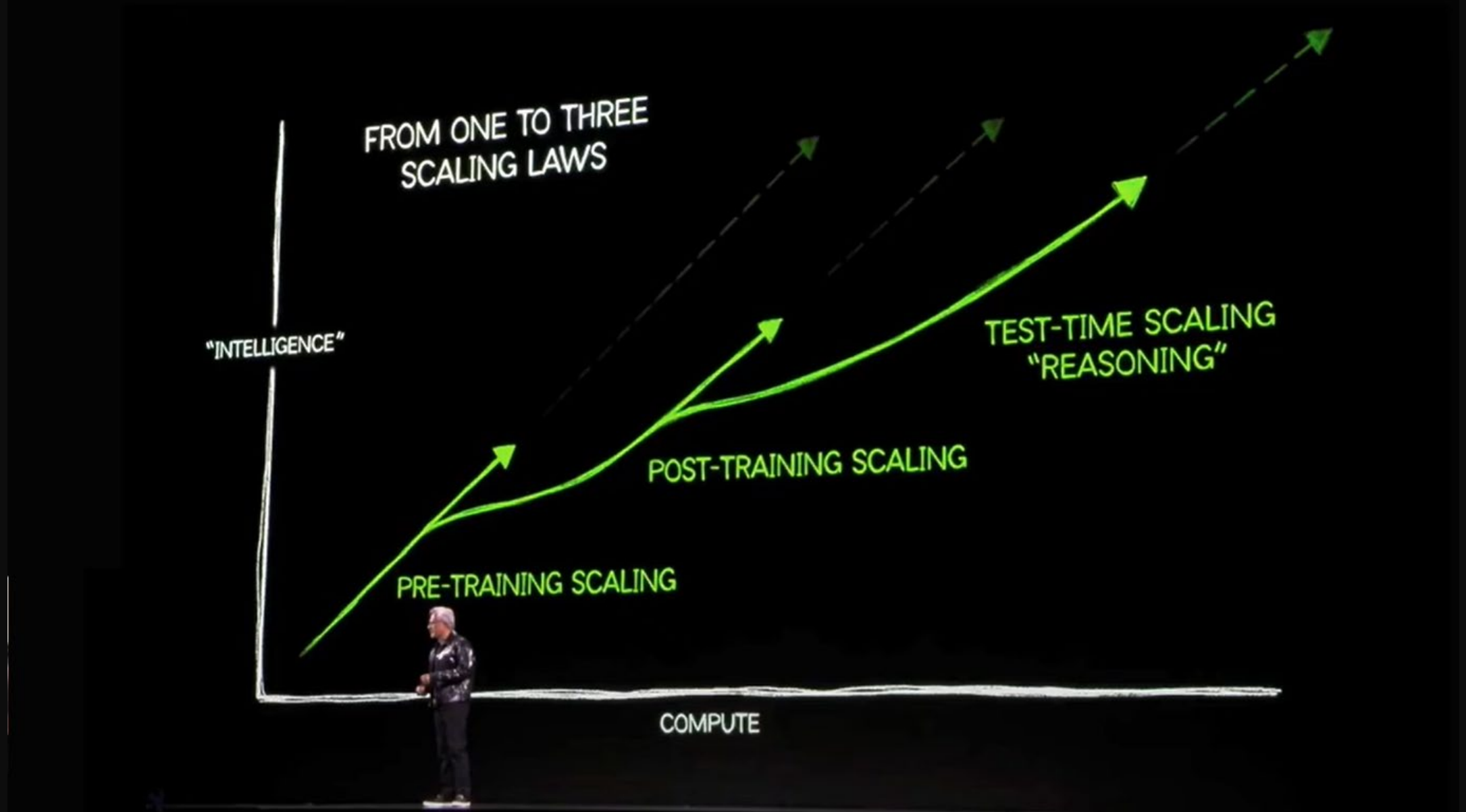
Focus on helpfulness, safety, and alignment.

Model generates responses → humans rank → model improves.

3. Inference

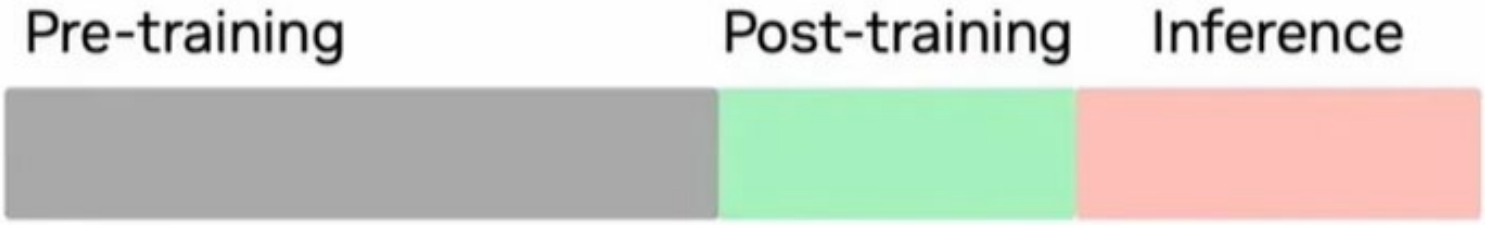
The final model is used to generate outputs based on user input.

Three Laws of Scaling



Reasoning

- Simulating step-by-step thinking to solve problems.
- Most reasoning appears during prompting (e.g., using *Chain-of-Thought*).
- Prompting models to "think step-by-step" **improves accuracy**,



Reasoning – Example 1

Prompt:

"Concatenate the last letter of the word *Artificial* with the last letter of the word *Intelligence*. What would you get?“

Answer 1: ✅ *le*

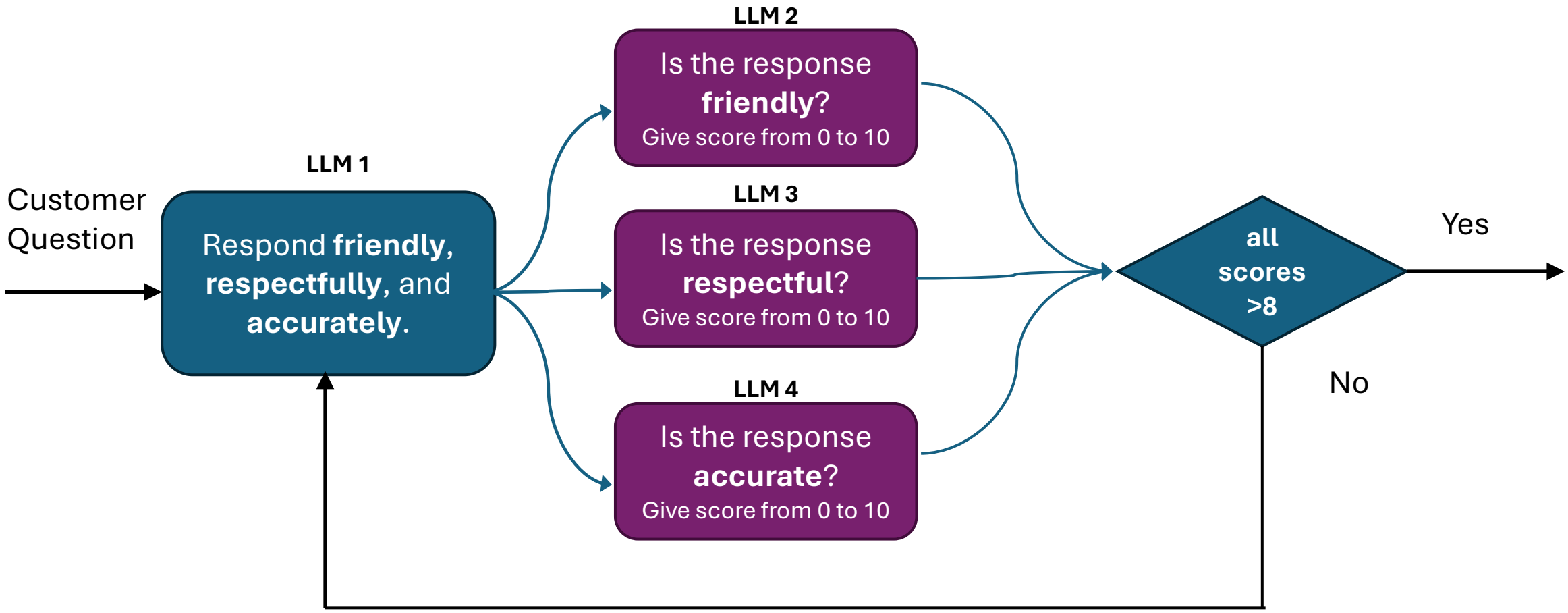
Answer 2 (Reasoning):

1.The last letter of *Artificial* is **l**

2.The last letter of *Intelligence* is **e**

3.Concatenating them gives: **l + e = le**

Reasoning – Example 2



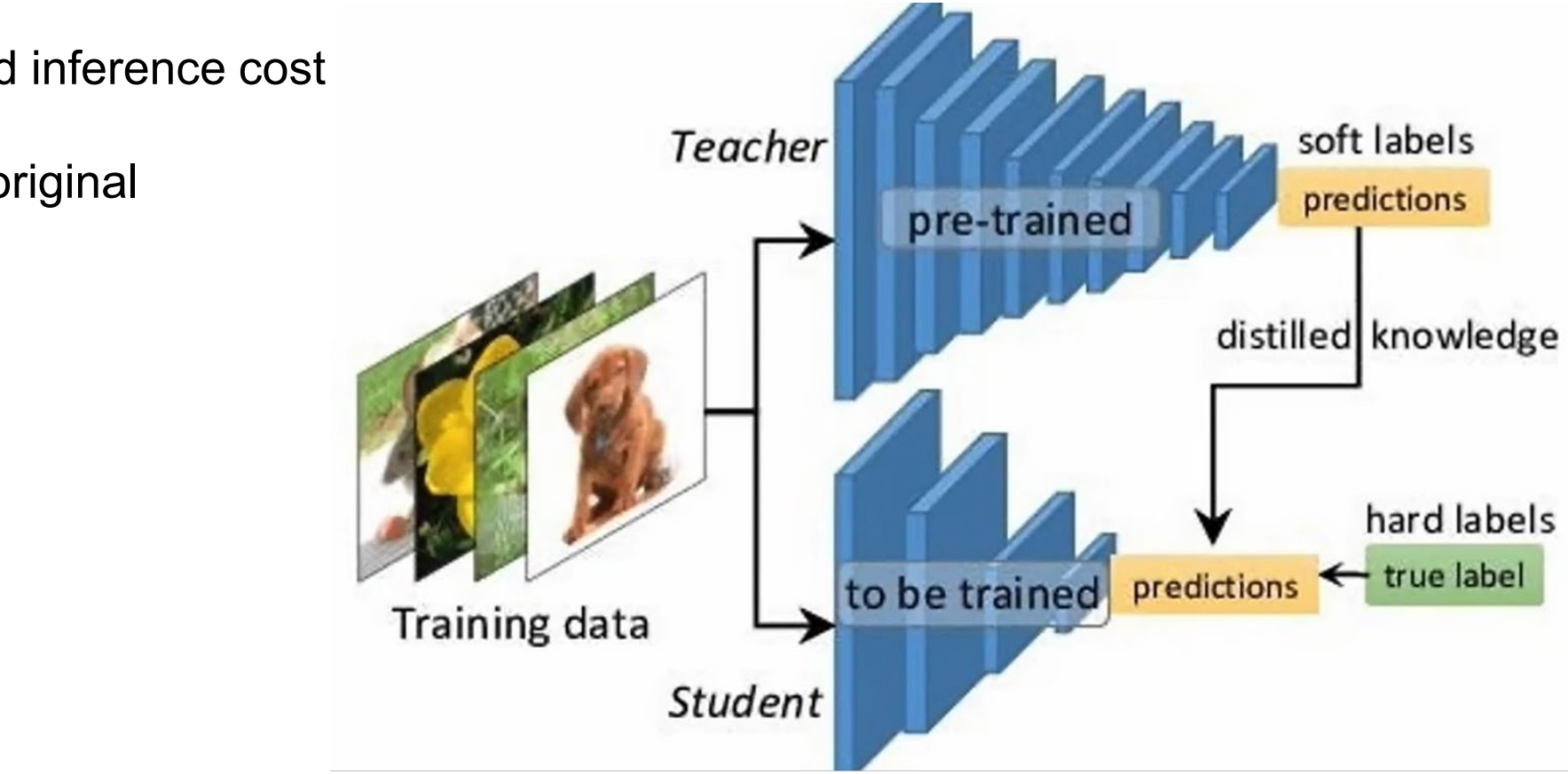
Is this the loop to infinite intelligence?

No

Distillation

- A technique to transfer knowledge from a large, powerful LLM (*teacher*) to a smaller, faster one (*student)*.

- Reduces model size and inference cost
- Preserves much of the original model's performance



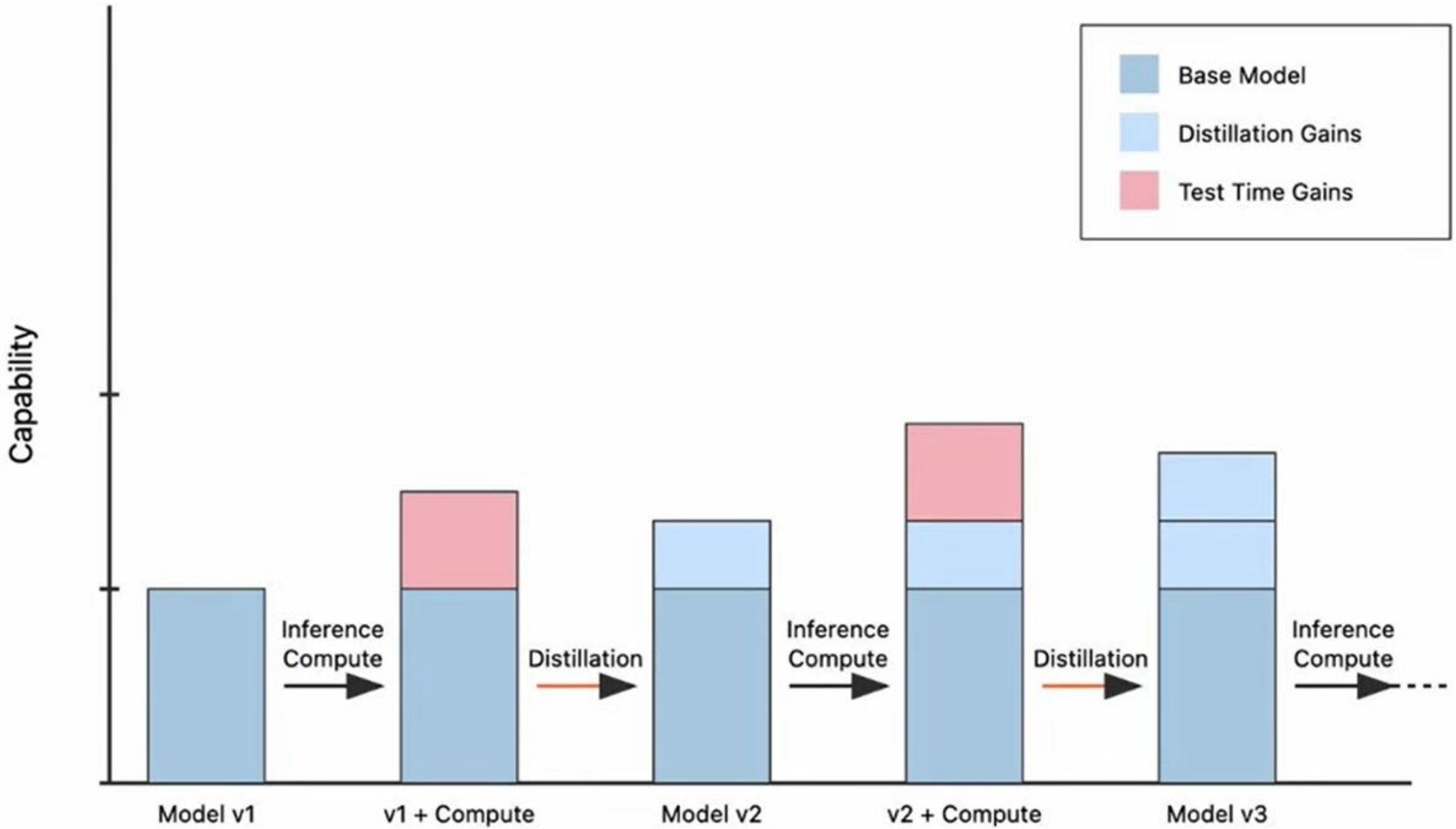
Evaluation and Results

Student

Teacher

	Sky-T1-32B-Preview	Qwen-2.5-32B-Instruct	QwQ	o1-preview
Math500	82.4	76.2	85.4	81.4
AIME2024	43.3	16.7	50.0	40.0
LiveCodeBench-Easy	86.3	84.6	90.7	92.9
LiveCodeBench-Medium	56.8	40.8	56.3	54.9
LiveCodeBench-Hard	17.9	9.8	17.1	16.3
GPQA-Diamond	56.8	45.5	52.5	75.2

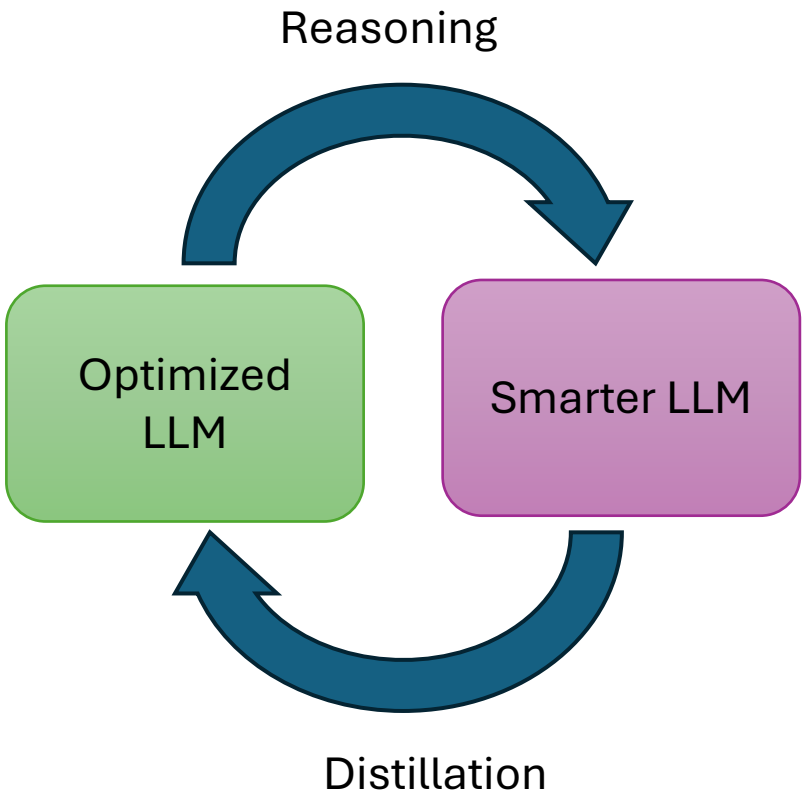
Model Capability Feedback Loop



Positive Feedback

- when the output of a system feeds back in and makes the next output stronger.

- Example: Microphone Screeching:
  - Mic picks up sound → speaker plays it → mic hears it louder → repeats → loud screech.



- Positive feedback **can** lead to instability or divergent behavior.

Positive Feedback Different Cases

- Stable
  - 0, 1/2, 3/4, 7/8, …

$$a[n] = a[n-1] + \left(\tfrac{1}{2}\right)^n$$

- Unstable
  - 2, 6, 14, …

$$a[n] = a[n-1] + 2^n$$

- Unstable
  - 0, 1, 1+1/2, 1+1/2+1/3, …

$$a[n] = a[n-1] + \frac{1}{n}$$

Conclusion

- **Could AI hit an unstable feedback loop?**
  We don’t know—and lack of evidence isn’t proof it can’t happen.

- **Even if it hasn’t yet, can we assume it never will?**
  No—future advances may change the dynamics.

- Staying informed about AI’s rapid evolution is crucial for us.

Question?

Second Part:
Job Market and Career Path

Career-path Advice

1. Smart decisions matter more than hard work.

2. Think 5–10 years ahead and act accordingly.

3. Invest in relationships, not just resume.

Guide for PhD Students

- What you learned in terms of techniques during your PhD may have limited value in industry.

- What truly matters is your ability to:
  - solve problems
  - learn quickly
  - focus deeply on a subject

- Jobs rarely match your thesis—adaptability matters more.

Job Hunting

- Job hunting is not a competition — it’s a matching game.
  - Don’t take rejection personally; it’s about fit, not your worth.
- The more you apply, the more chances you create.
- Too little prep leads to weak applications; too much prep slows you down. Balance is key.
- The first job is often the hardest to get.

The Job Application Equation

- These three should be in line:
    - Advertised position
    - Your expected salary
    - Your CV/presentation

Interview

Believe in yourself – If you don’t, no one else will.

Keep it simple – Avoid overly technical jargon; be clear and relatable.

Show intent – Focus on how you want to solve problems and add value.

Last Advice

Be Kind to Yourself

Question?