Model Distillation Risk

model-distillation-risk · safety · concept

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Summary

The risk that a closed-weight frontier model's capabilities can be partially recovered by training a smaller open-weight model on the closed model's outputs, undermining the governance assumption that closed weights confer capability containment.

At a glance

Used by

0 instrument(s)

Related concepts

ai-supply-chain, capability-elicitation, frontier-tier, compute-threshold, inference-time-compute

Primary source

Hinton, G., Vinyals, O., Dean, J. (2015), 'Distilling the Knowledge in a Neural Network' — the foundational distillation paper; the governance-relevant adaptation runs through Alpaca/Vicuna (2023) and DeepSeek-R1 (2025).

Details

Knowledge distillation (Hinton et al. 2015, 'Distilling the Knowledge in a Neural Network') is a benign technique for compressing teacher models into smaller student models. The governance concern is that distillation works across organisational boundaries: an attacker (or unaligned actor) can query a closed frontier API at scale, collect input-output pairs, and train an open-weight model that approximates the closed teacher's capabilities. Empirical examples have driven the policy debate: Alpaca + Vicuna (Stanford, 2023) demonstrated that 52K-100K instruction-following examples from GPT-3.5 sufficed to produce a competent open student; DeepSeek-R1's Jan 2025 release used distillation-from-traces to produce reasoning capabilities that approach o1-class systems. Industry terms-of-service (OpenAI, Anthropic, Google) prohibit using outputs to train competing models, but enforcement against jurisdictionally-distant actors is limited.

The governance implication is structural: the open-vs-closed debate (Llama, Mistral, DeepSeek vs. Anthropic, OpenAI, Google DeepMind) hinges partly on whether closed-weight release actually contains capability. If distillation is robust, closed-vs-open is a capability-acquisition-delay measure rather than a capability-containment measure. EU AI Act, US EO 14110, and G7 Hiroshima all presume closed-weight containment in their compute-threshold + capability-evaluation regimes; the distillation effect is not explicitly addressed. Anthropic, OpenAI, and DeepMind have published distillation-defence research (output watermarks, model-fingerprint methods) but no robust technical fix exists.

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CHICAGO

Policy Window. n.d.. "Model Distillation Risk." Wiki article (Concept). https://policywindow.org/wiki/model-distillation-risk.

HARVARD

Policy Window (n.d.) 'Model Distillation Risk', Wiki article — Concept, available at: https://policywindow.org/wiki/model-distillation-risk.

OSCOLA

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