

Results: [20, 35] Crossings

Jake Weatherhead

November 7, 2025

The CNN (88M params) and the ViT (86M params) were fine-tuned on a new dataset \mathcal{D} where:

$$\mathcal{D} = \mathcal{D}_{\text{train}} \cup \mathcal{D}_{\text{val}} \cup \mathcal{D}_{\text{test}},$$

$$|\mathcal{D}| = 560,000 \text{ diagrams},$$

$$|\mathcal{D}_{\text{train}}| = 0.8 \cdot |\mathcal{D}| = 448,000 \text{ diagrams},$$

$$|\mathcal{D}_{\text{val}}| = |\mathcal{D}_{\text{test}}| = 0.1 \cdot |\mathcal{D}| = 56,000 \text{ diagrams},$$

$$\forall x \in \{\mathcal{D}_{\text{train}}, \mathcal{D}_{\text{val}}, \mathcal{D}_{\text{test}}\}, x \in \mathcal{U} \cup \mathcal{K} \text{ and } |\mathcal{U}| = |\mathcal{K}|.$$

Each split in \mathcal{D} contained knots with $n \in N := \{20, 21, \dots, 35\}$ crossings. For all distinct $a, b \in N$, each split contained an equal number of a and b -crossing unknot and non-trivial knot diagrams.

Learning Curves

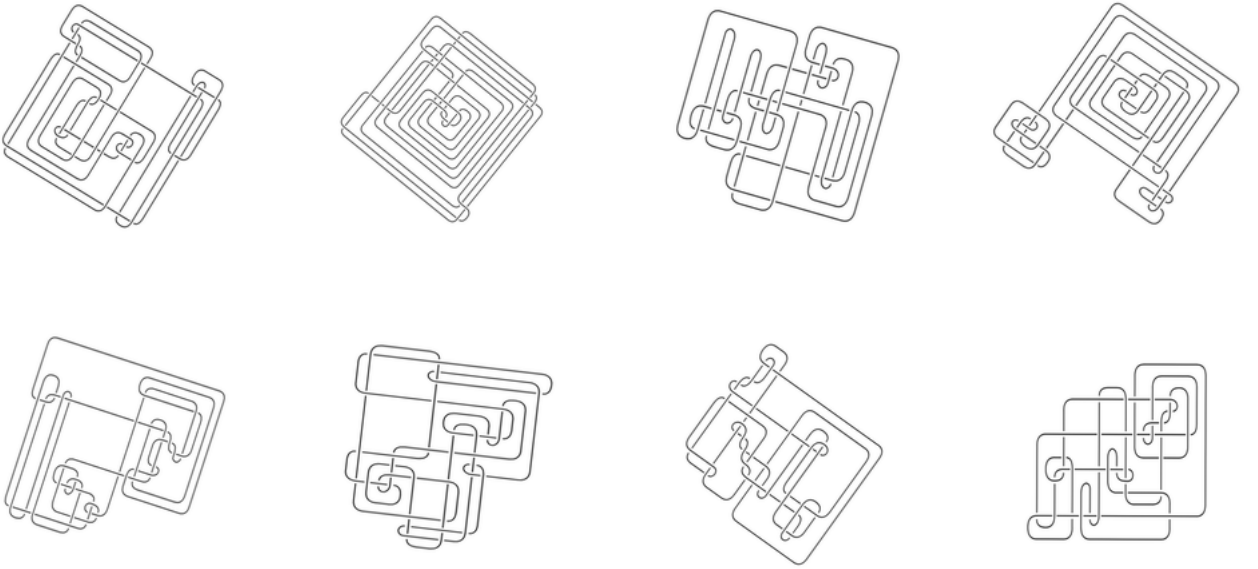


Figure 1: 35 crossing unknots (top row) and non-trivial knots (bottom row) in $\mathcal{D}_{\text{test}}$.

CNN Saliency Maps

Saliency maps for knots in \mathcal{D}_{test} from the CNN that performed the best on \mathcal{D}_{test} .

CNN TP: True Unknots Predicted as Unknots

CNN FN: True Unknots Predicted as Knots

CNN TN: True Knots Predicted as Knots

CNN FP: True Knots Predicted as Unknots

ViT Saliency Maps

Saliency maps for knots in \mathcal{D}_{test} from the ViT that performed the best on \mathcal{D}_{test} .

ViT TP: True Unknots Predicted as Unknots

ViT FN: True Unknots Predicted as Knots

ViT TN: True Knots Predicted as Knots

ViT FP: True Knots Predicted as Unknots