

NEURAL NETWORKS AS MINDS

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Agenda

To explore loose parallels between 9
deep learning techniques and traits of
'intelligence', starting from simple
ideas to more complex ones

Objective

To inspire cross-disciplinary interest in
neural network capability to exhibit
"intelligent" behavior

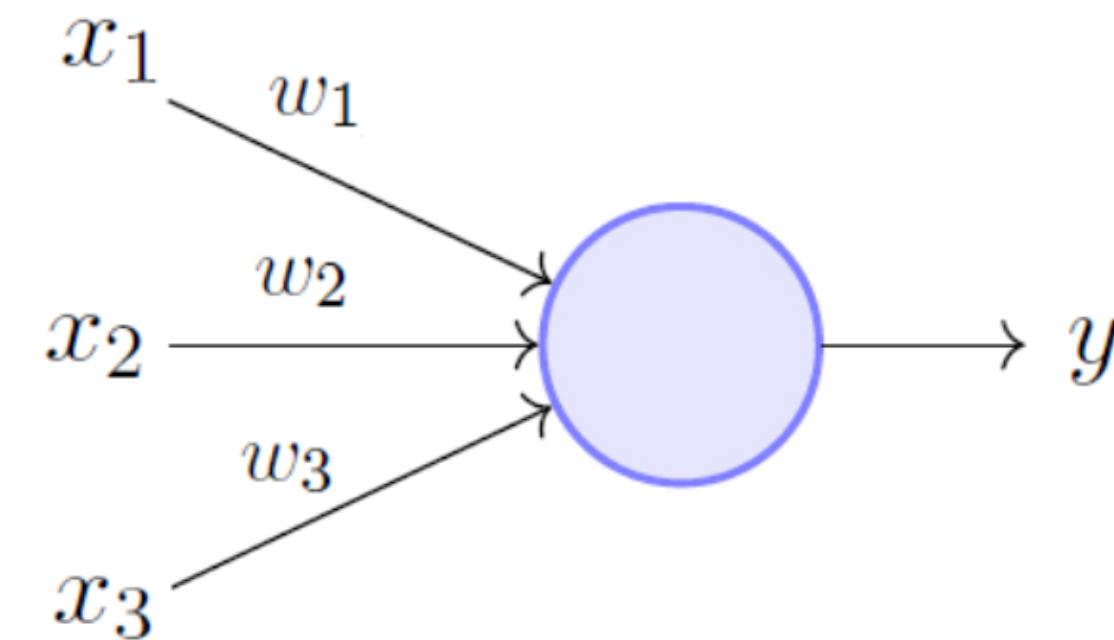
Quick Lingo Catch-Up

$$y = f(x)$$

The goal of supervised machine learning is to find a model f that produces a target/output/label y given an input x by learning from a dataset of x - y associations.

Perceptrons as Neurons

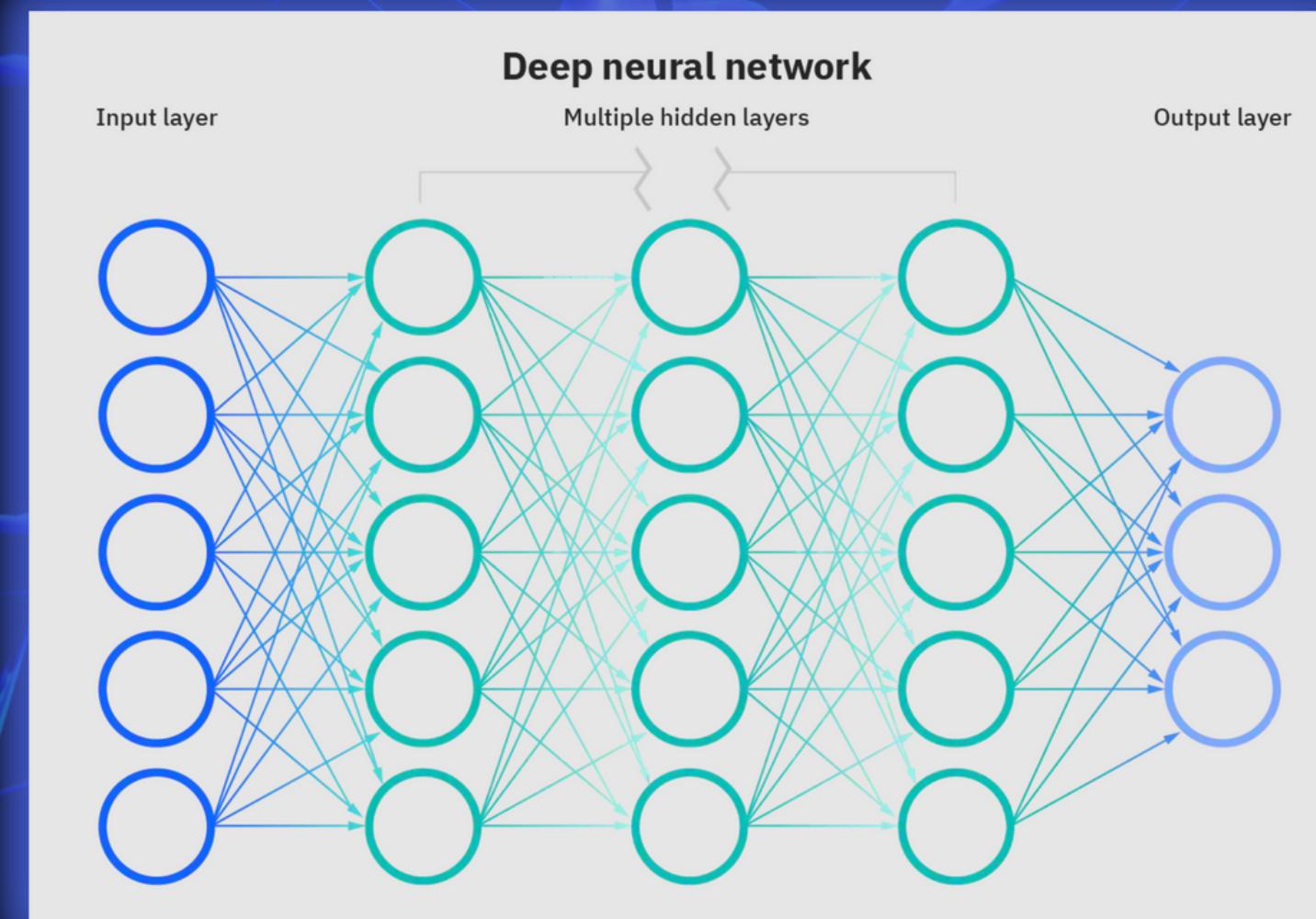
Perceptrons act as a unit of extraction. By stacking them together in intricate patterns, we can obtain sophisticated model output behavior.



Perceptron Model (Minsky-Papert in 1969)

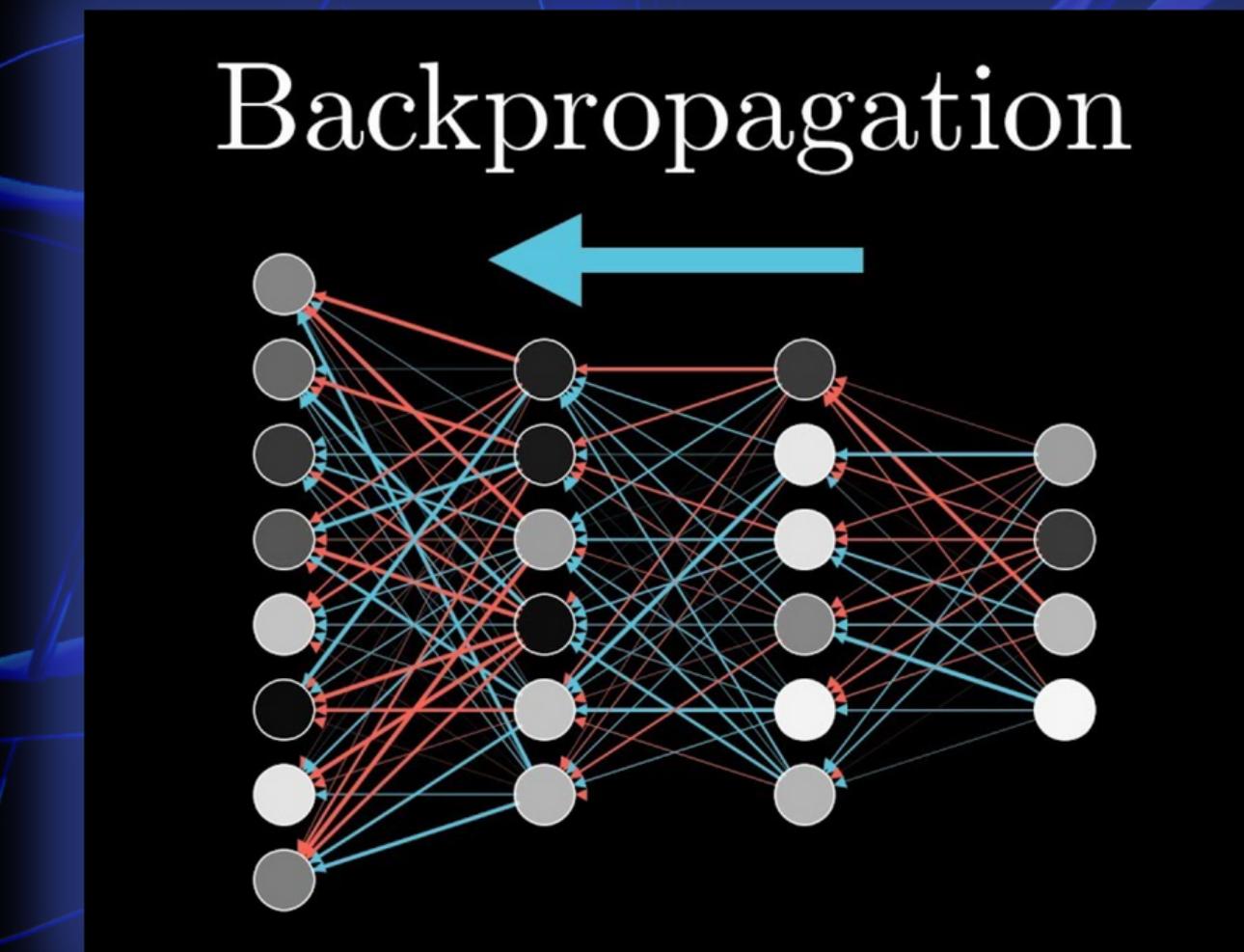
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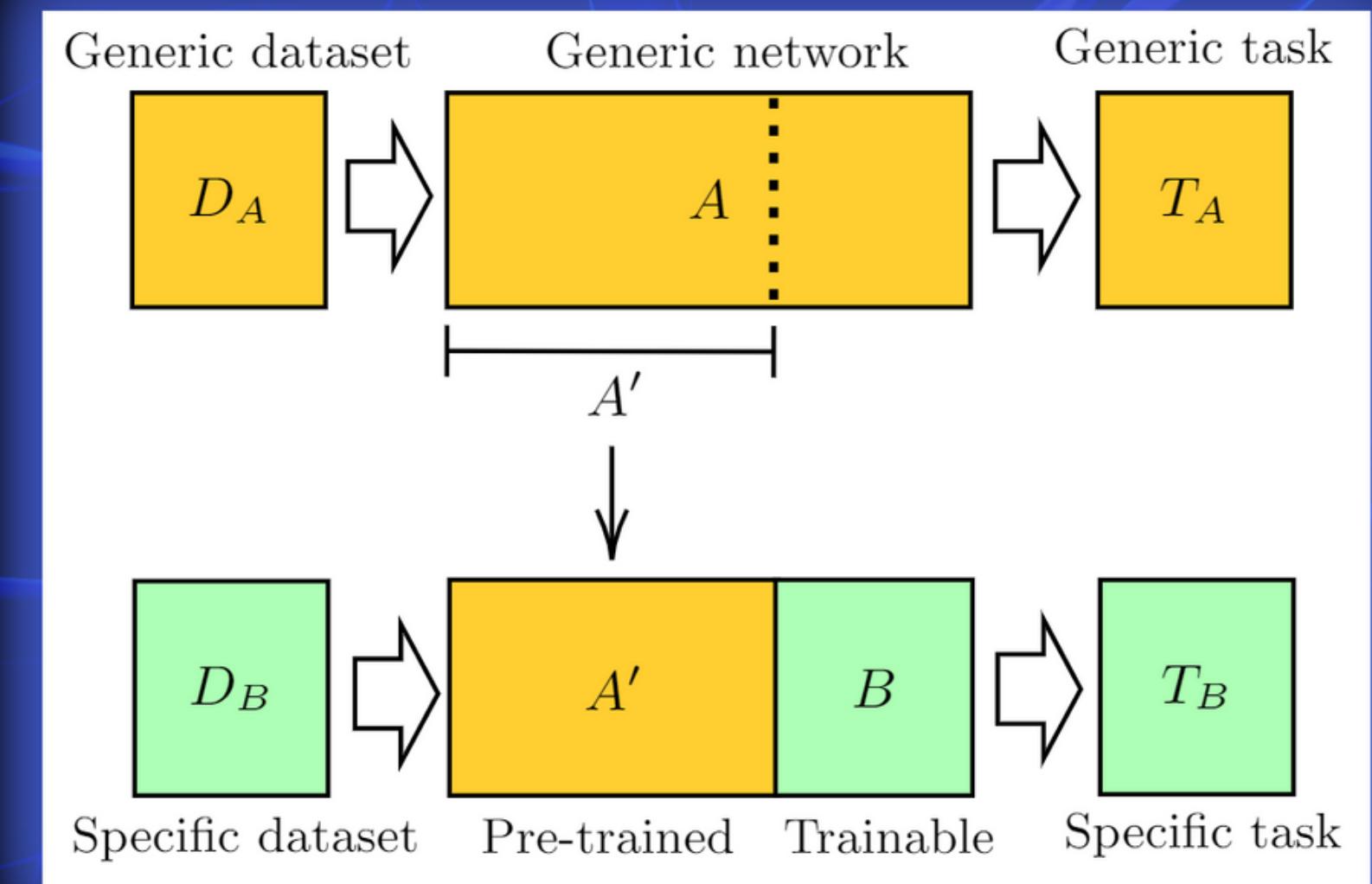
Backpropagation as Learning

Neural networks update internal weights with corresponding direction and magnitude in response to a feedback mechanism.



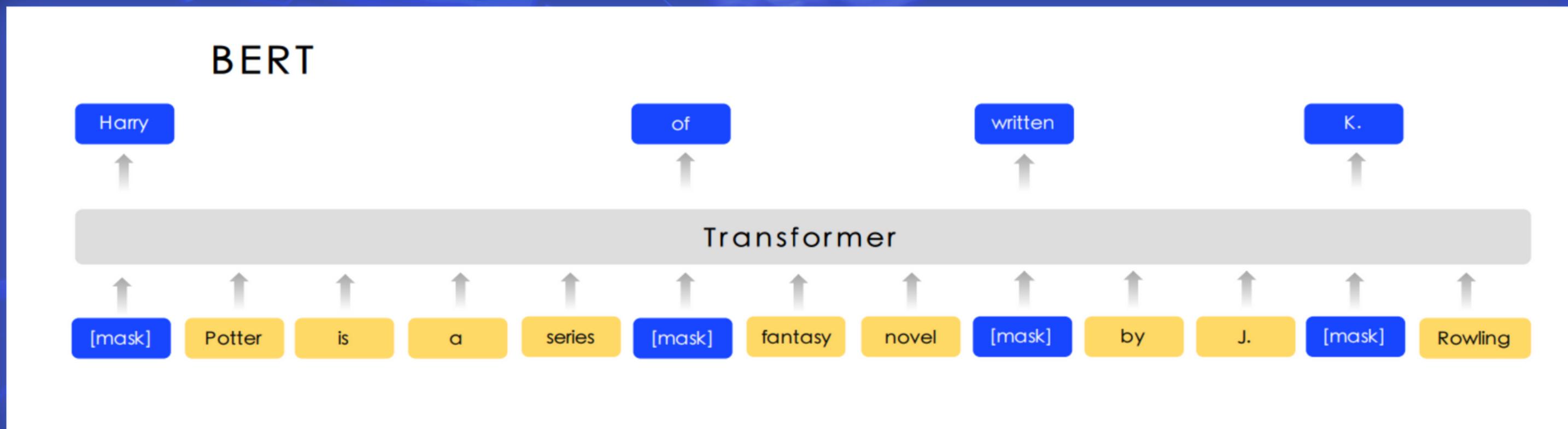
Transfer Learning as Skill Adaptation

Neural networks trained on one standard task can successfully be trained on another specialized task.

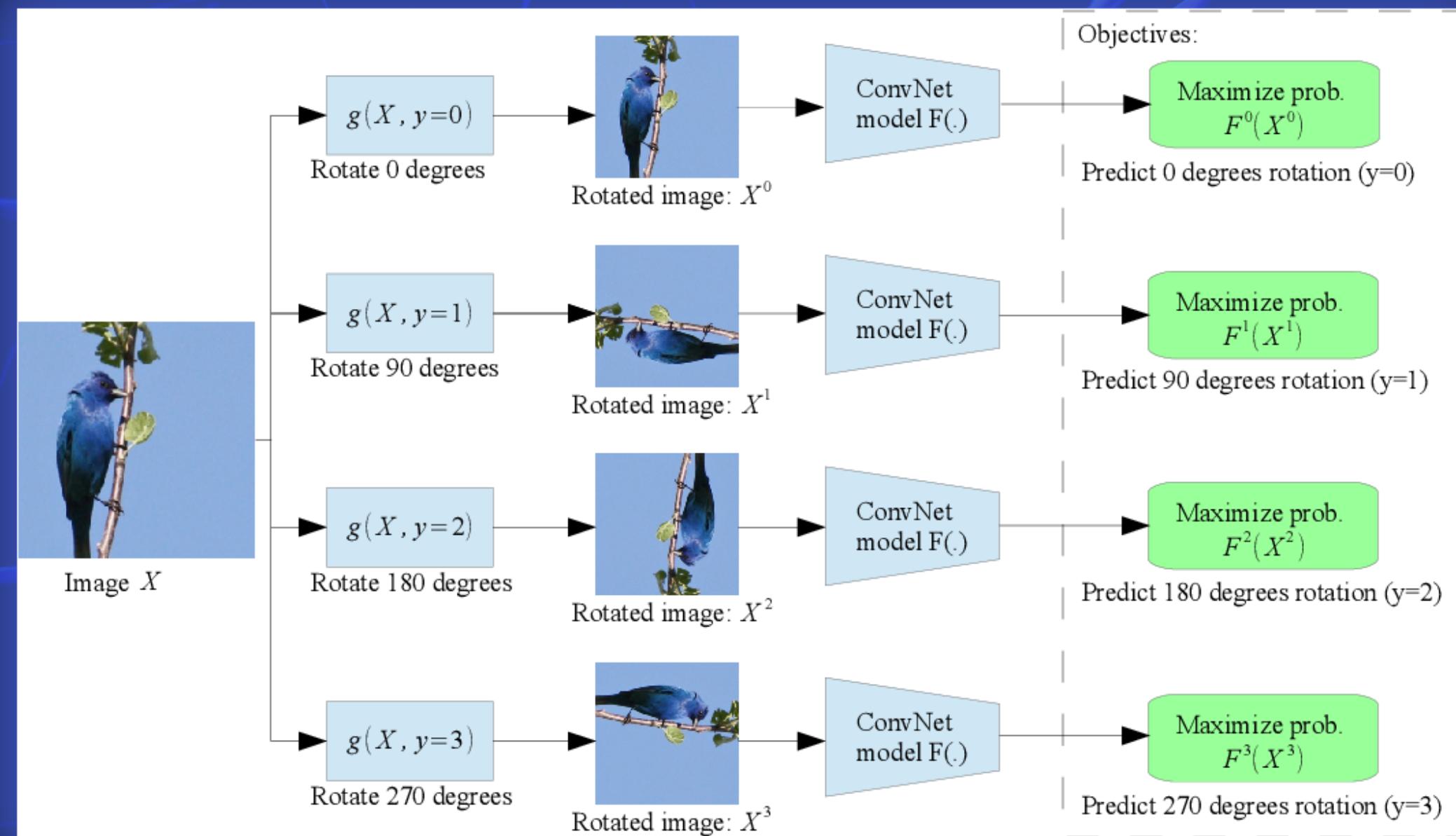


Self-Supervised Learning as Exploration Before Training

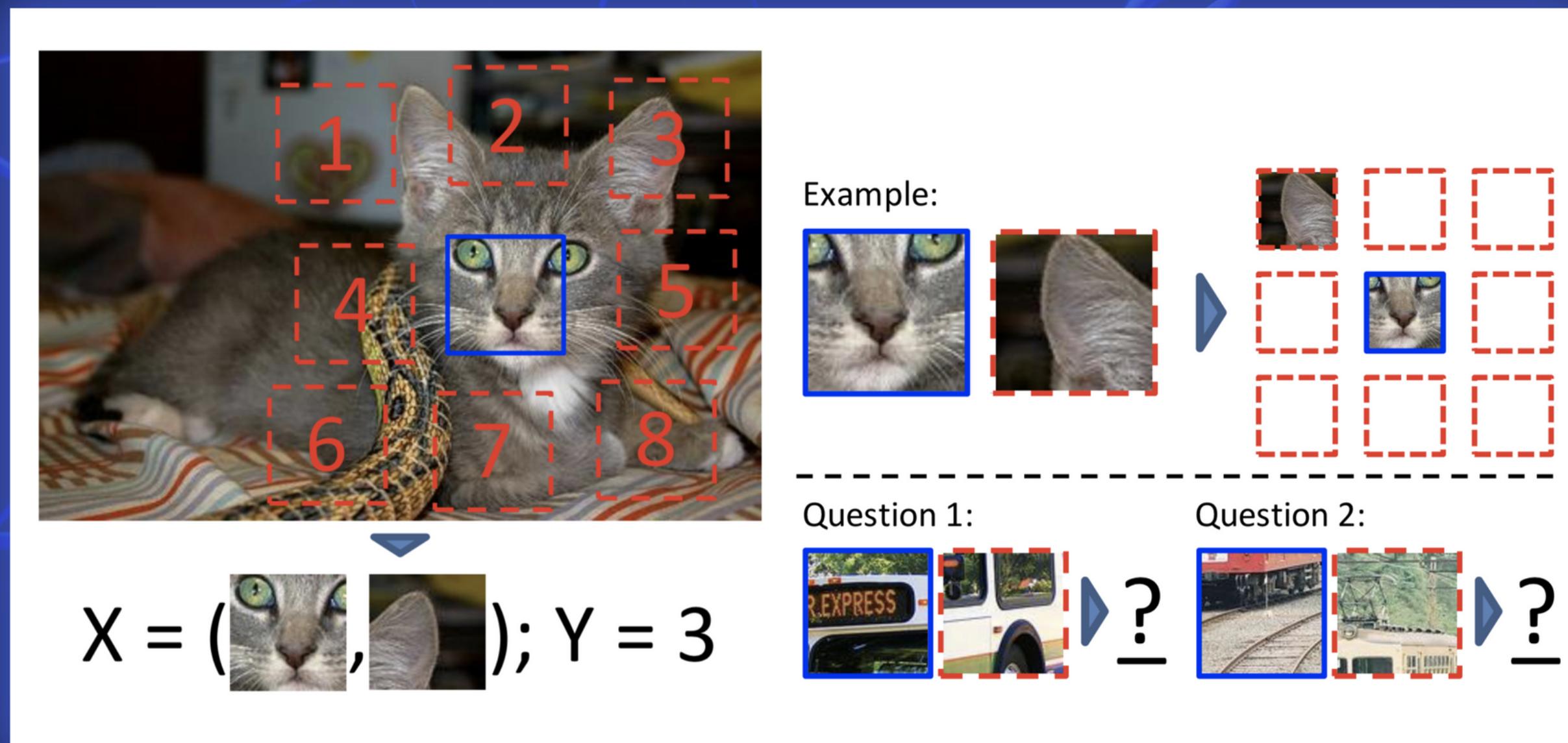
The model explores the data landscape without learning labels, then is trained on the specialized task with labels.



Self-Supervised Learning as Exploration Before Training

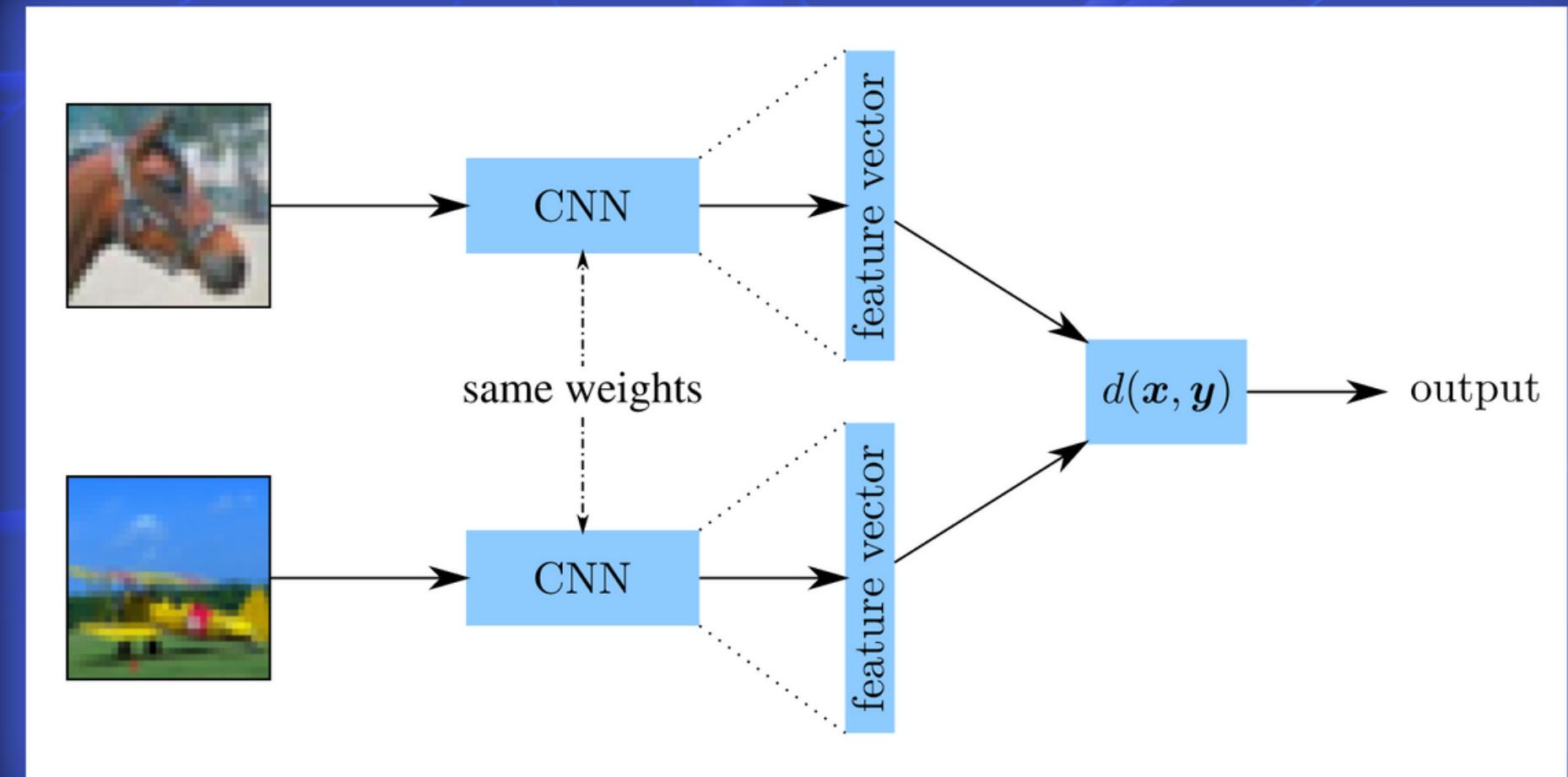


Self-Supervised Learning as Exploration Before Training



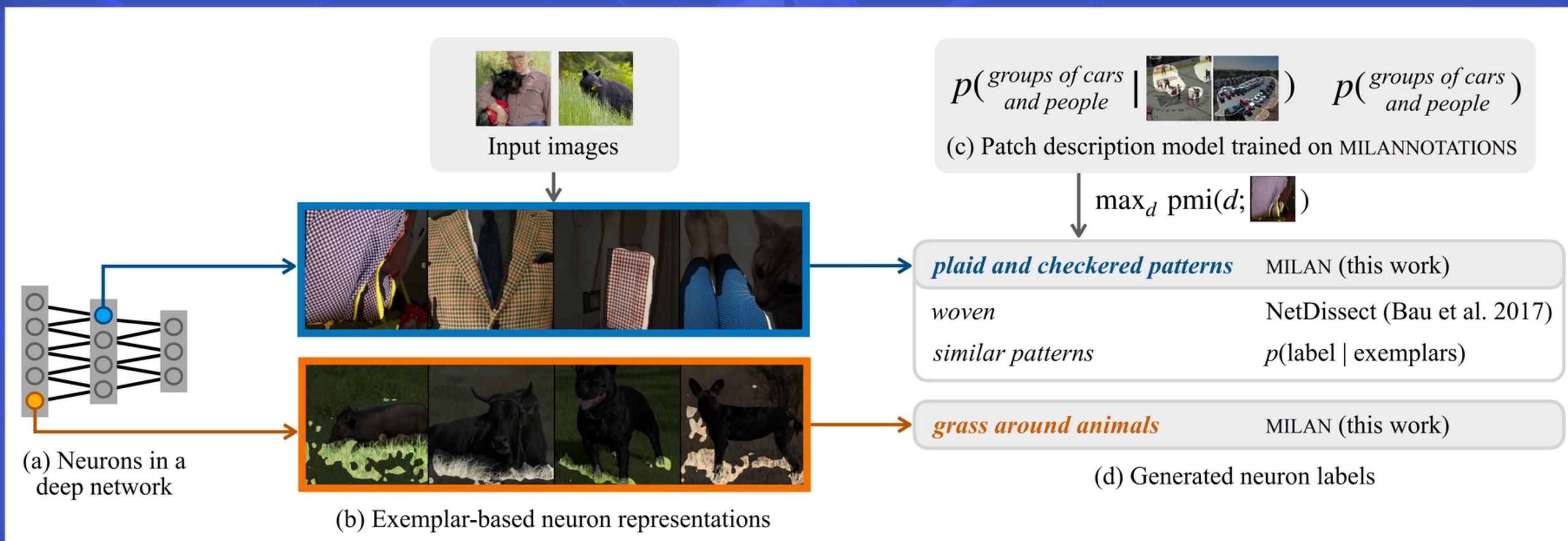
Few-Shot Learning as the "Realistic Learning Regime"

Few-Shot learning models generalize from few samples per class.



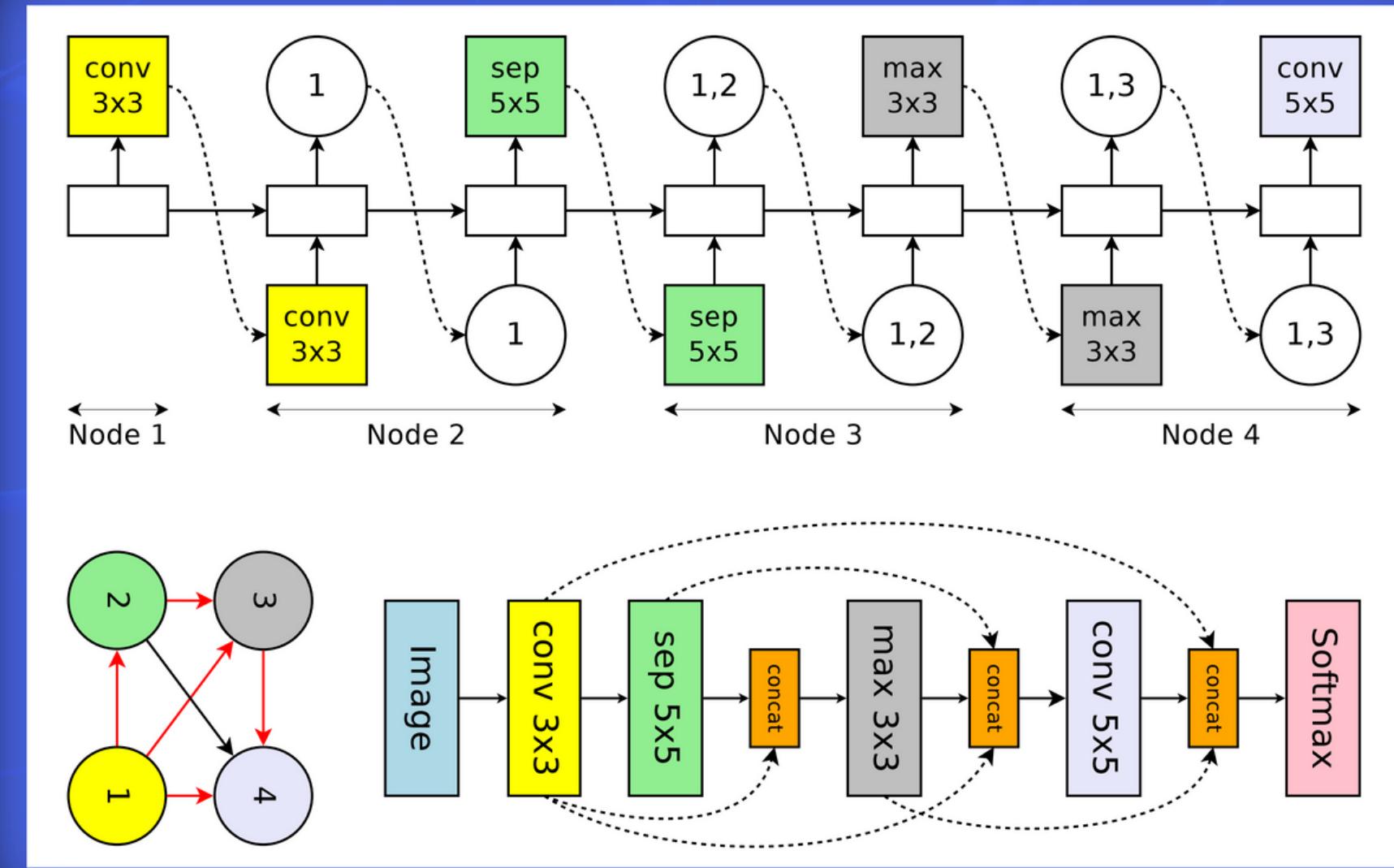
NL Weight Interpretation as Decision Explanation

Natural language descr. are discovered from model weights.



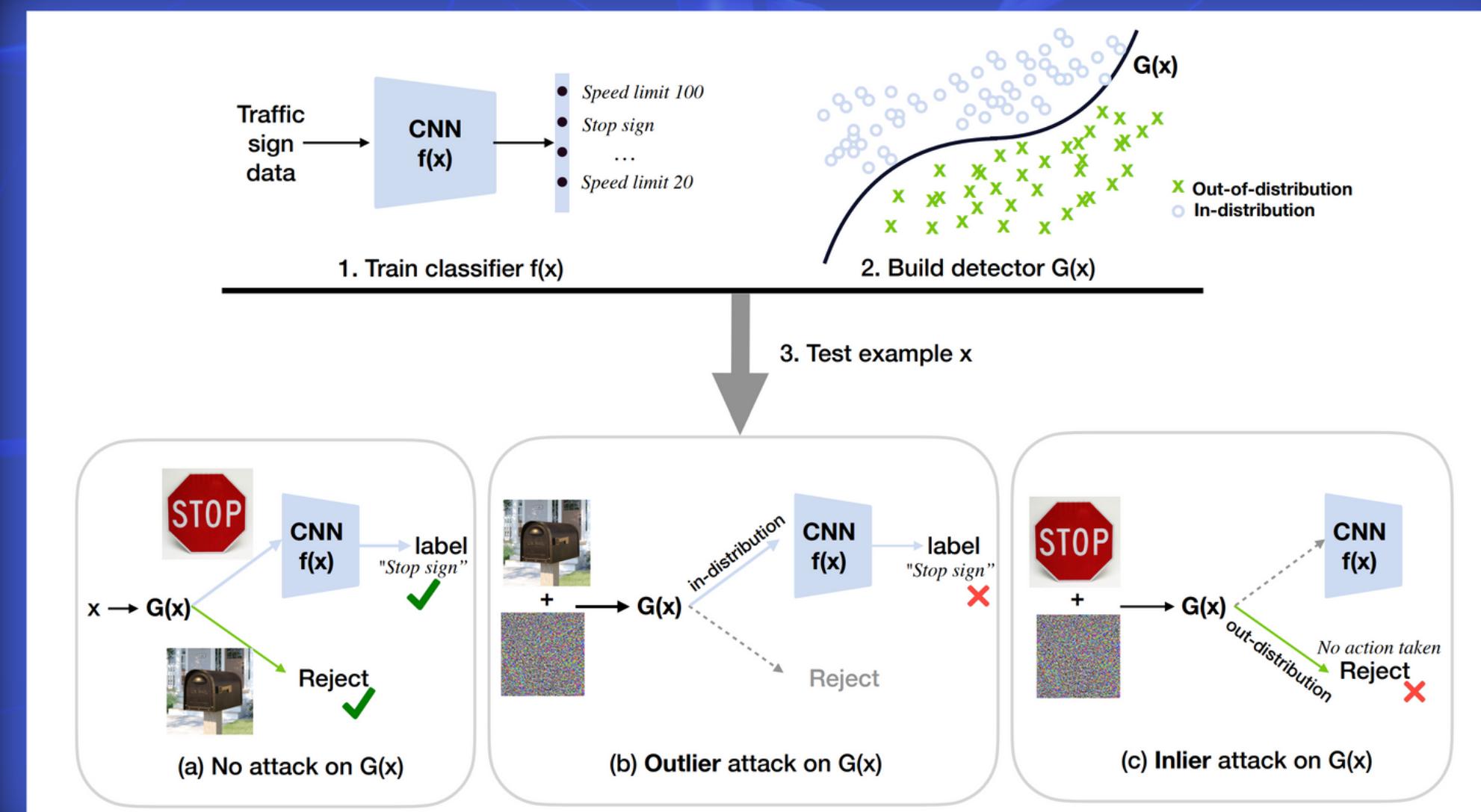
Neural Architecture Search as Meta-Reflection

NNs can be used to generate successful NN architectures.



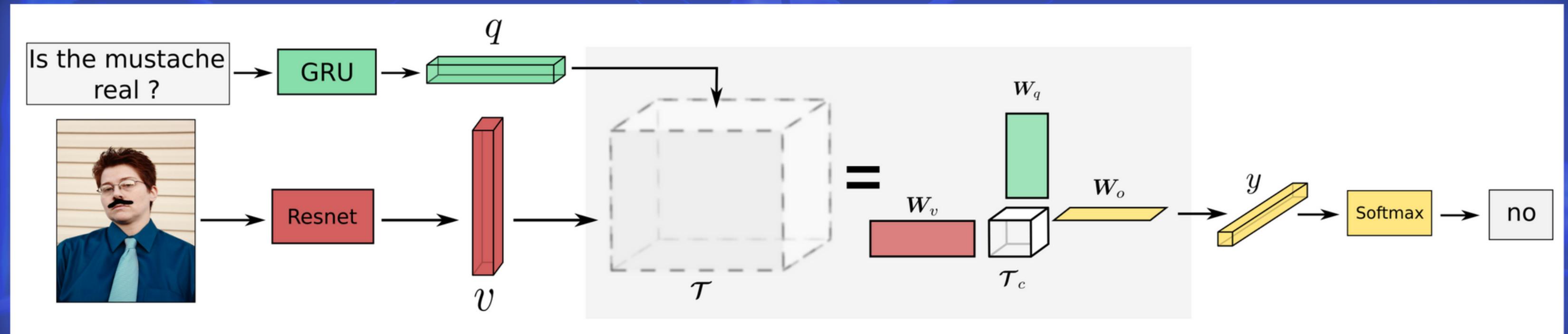
OOD Detection as Knowing When You Have No F\$(%ing Idea What The Answer Is

Out of Distribution (OOD) detection allows a system to be 'self-conscious' of its knowledge representation/prediction limits.



Multimodal Learning as Human-like Perception & Interaction

Models can take in and output multiple modalities at once.



Summary of Discussed Ideas

1. **Perceptrons** as Neurons
2. **Backpropagation** as Learning
3. **Transfer Learning** as Skill Adaptation
4. **Self-Supervised Learning** as Exploring Before Training
5. **Few-Shot Learning** as the "Realistic Learning Regime"
6. **NL Weight Interpretation** as Decision Explanation
7. **Neural Architecture Search** as Meta-Reflection
8. **OOD Detection** as Knowing When You Don't Know
9. **Multimodal Detection** as Human-Like Perception & Interaction