

An Intersection of Theoretical Math and Deep RL

MLOps Lightning Talk!

Dylan Skinner - Tuesday, 26 March 2024



KNOT THEORY 35:21



How The Most Useless Branch of Math Could Save Your Life

Veritasium · 6.3M views · 6 months ago



Knot Theory!

Knots

The background of the slide features a series of overlapping, wavy, horizontal bands in various shades of blue and dark blue, creating a layered, mountain-like or ocean-like effect. The top of the slide is a solid dark blue.

Knot Theory!

Knots

- Knots can be thought of as taking the two ends of a necklace

Knot Theory!

Knots

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- Tying a knot in the middle of the necklace

Knot Theory!

Knots

- Knots can be thought of as taking the two ends of a necklace
- Tying a knot in the middle of the necklace
- Clasping the two ends together

Knot Theory!

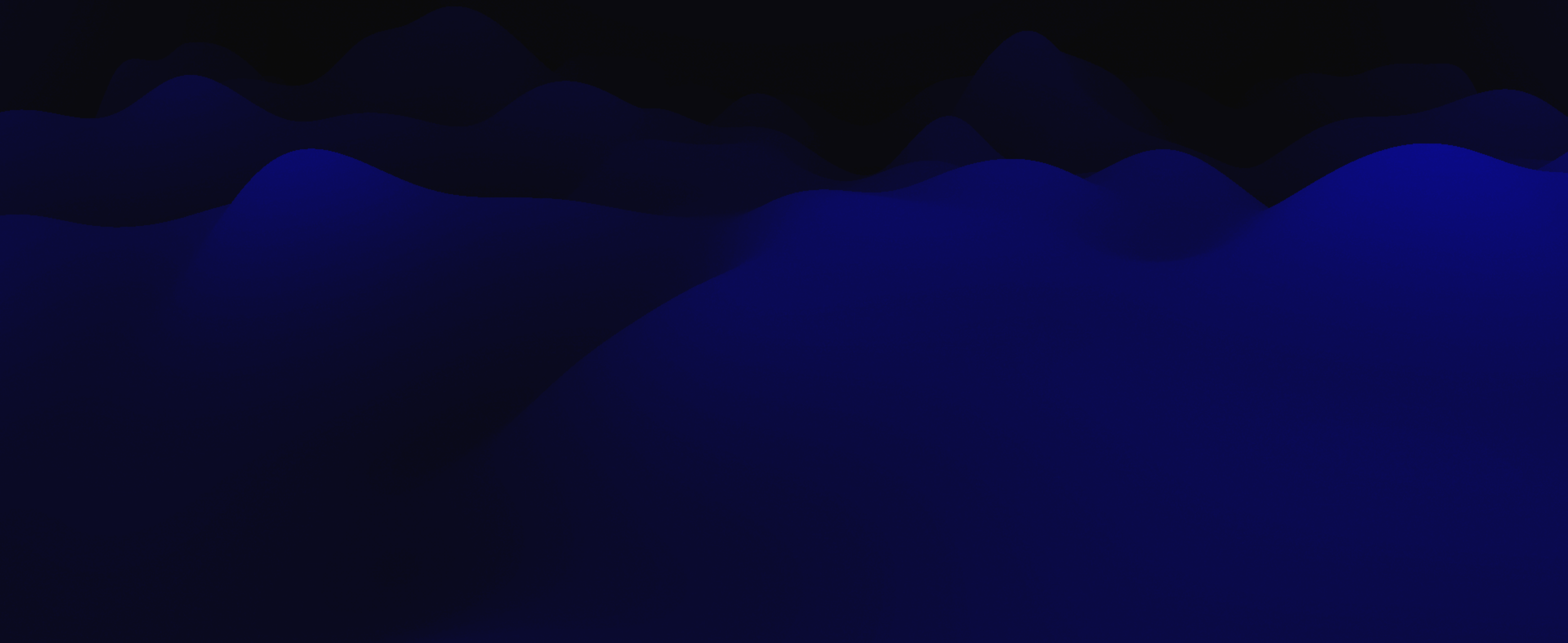
Knots

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Knot Theory!

Braids



Knot Theory!

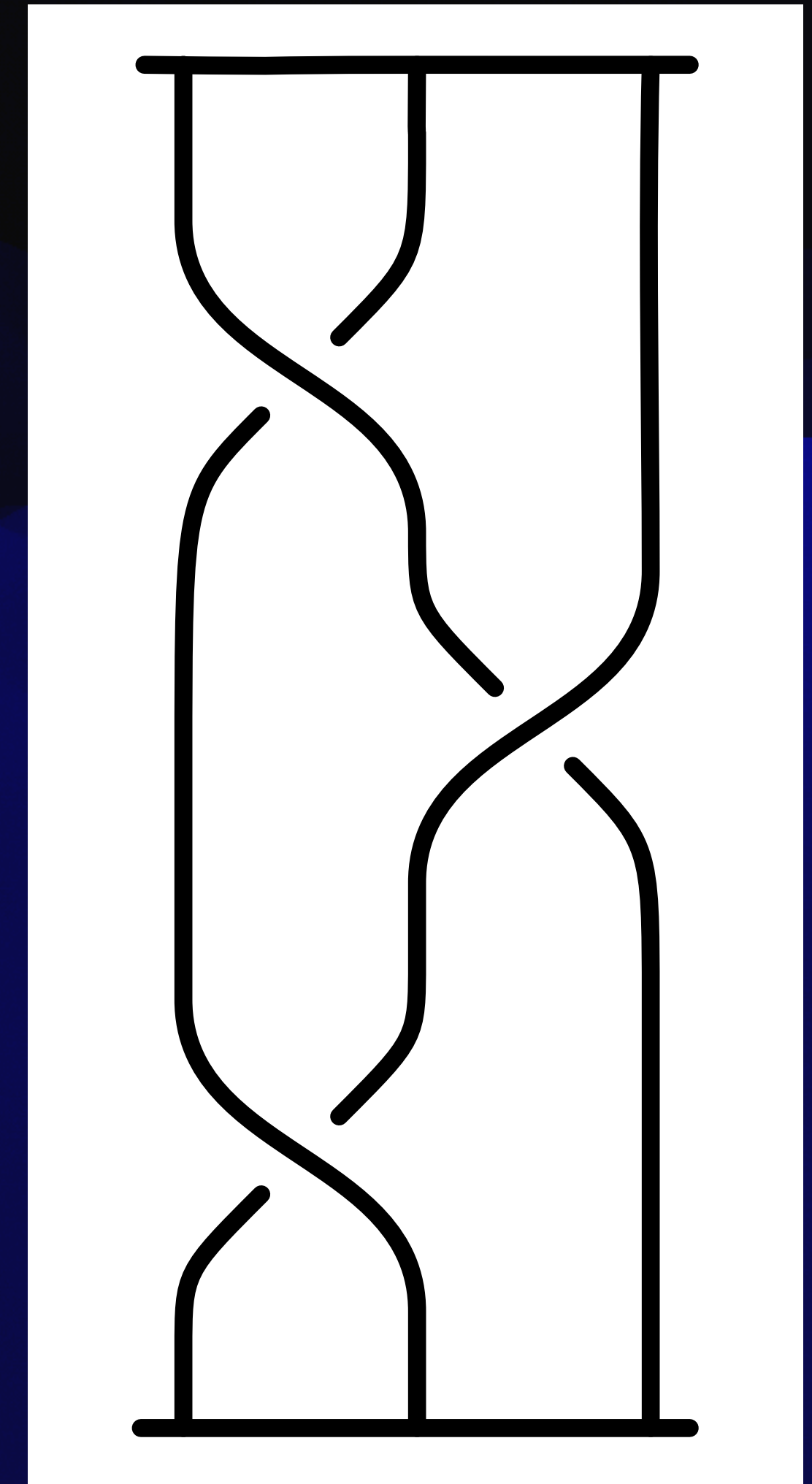
Braids

- Braids are another way of representing knots

Knot Theory!

Braids

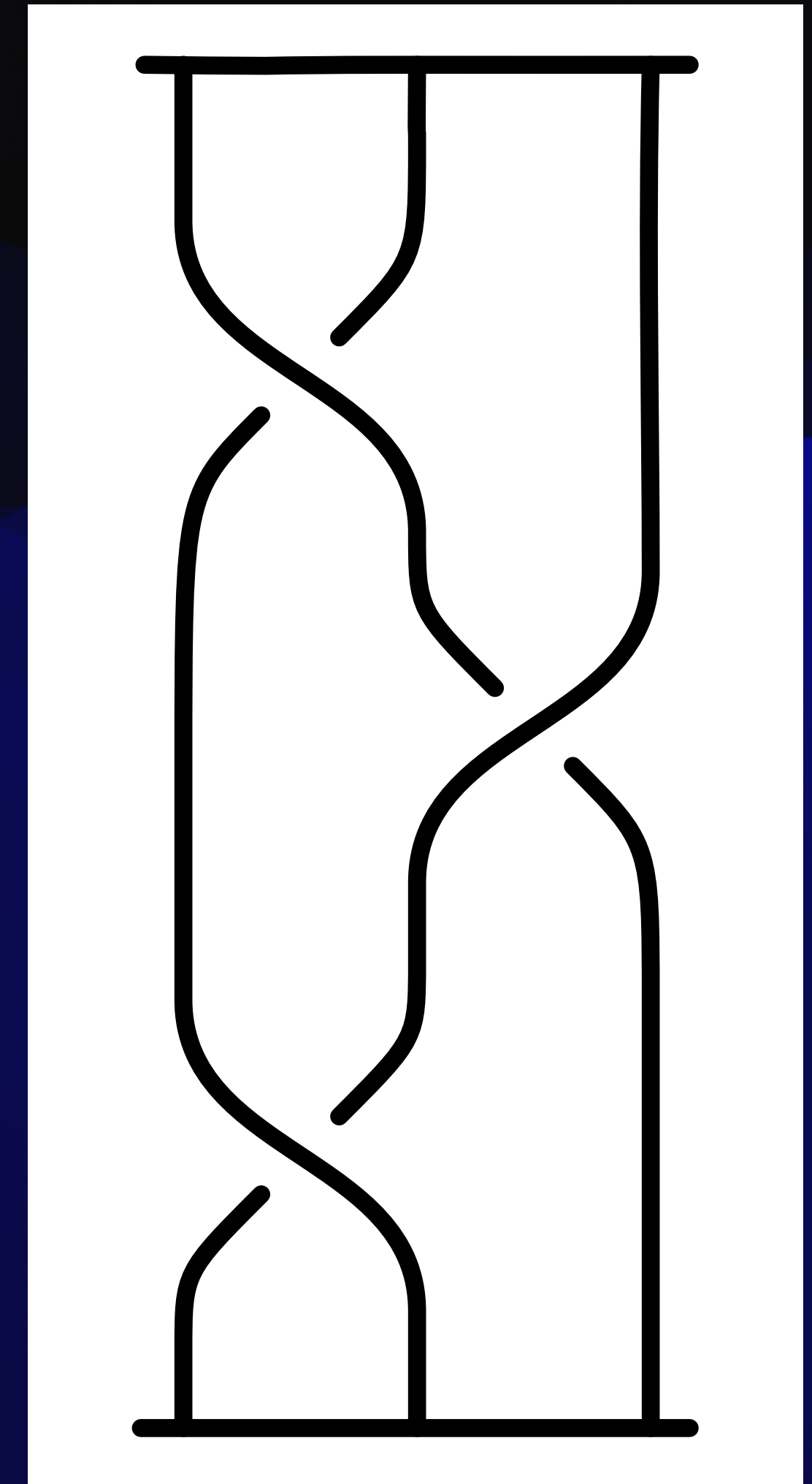
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Knot Theory!

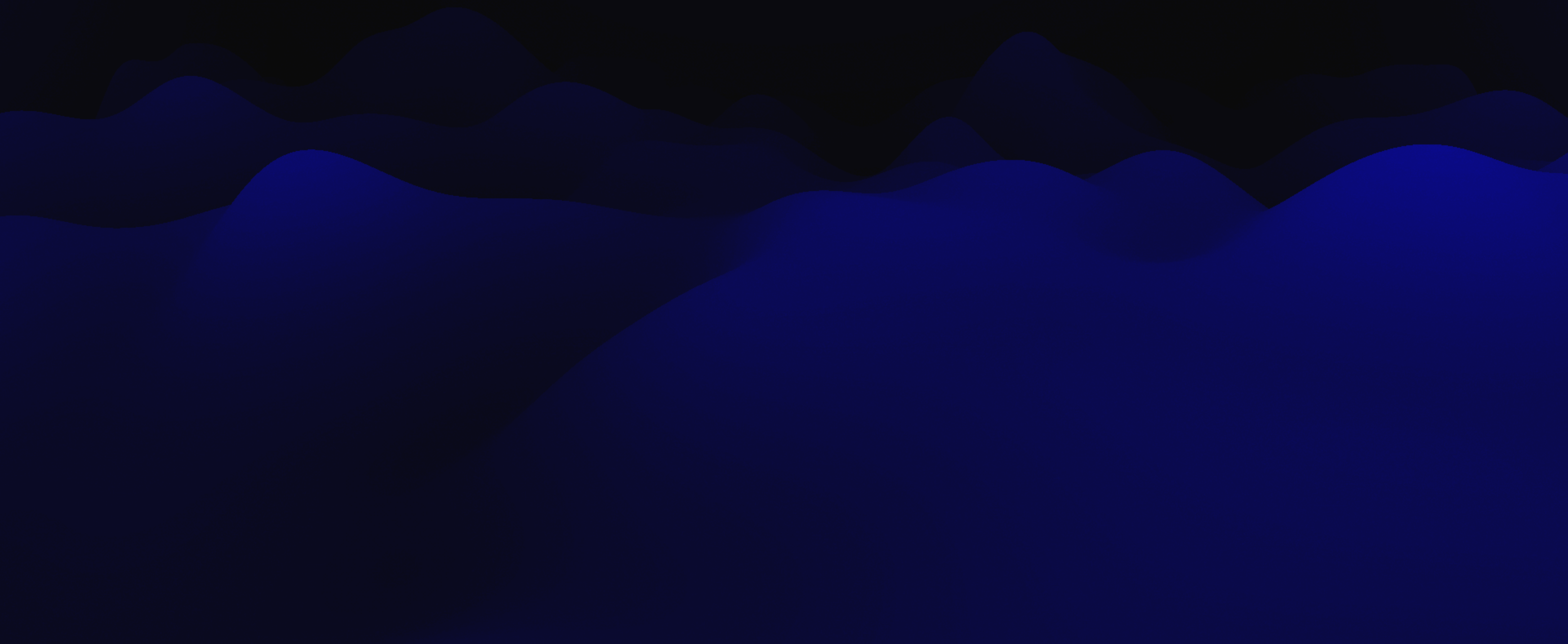
Braids

- Braids are another way of representing knots
- You can “change” braids by moving the strands around



Reinforcement Learning

Main Idea



Reinforcement Learning

Main Idea



Agent

Reinforcement Learning

Main Idea



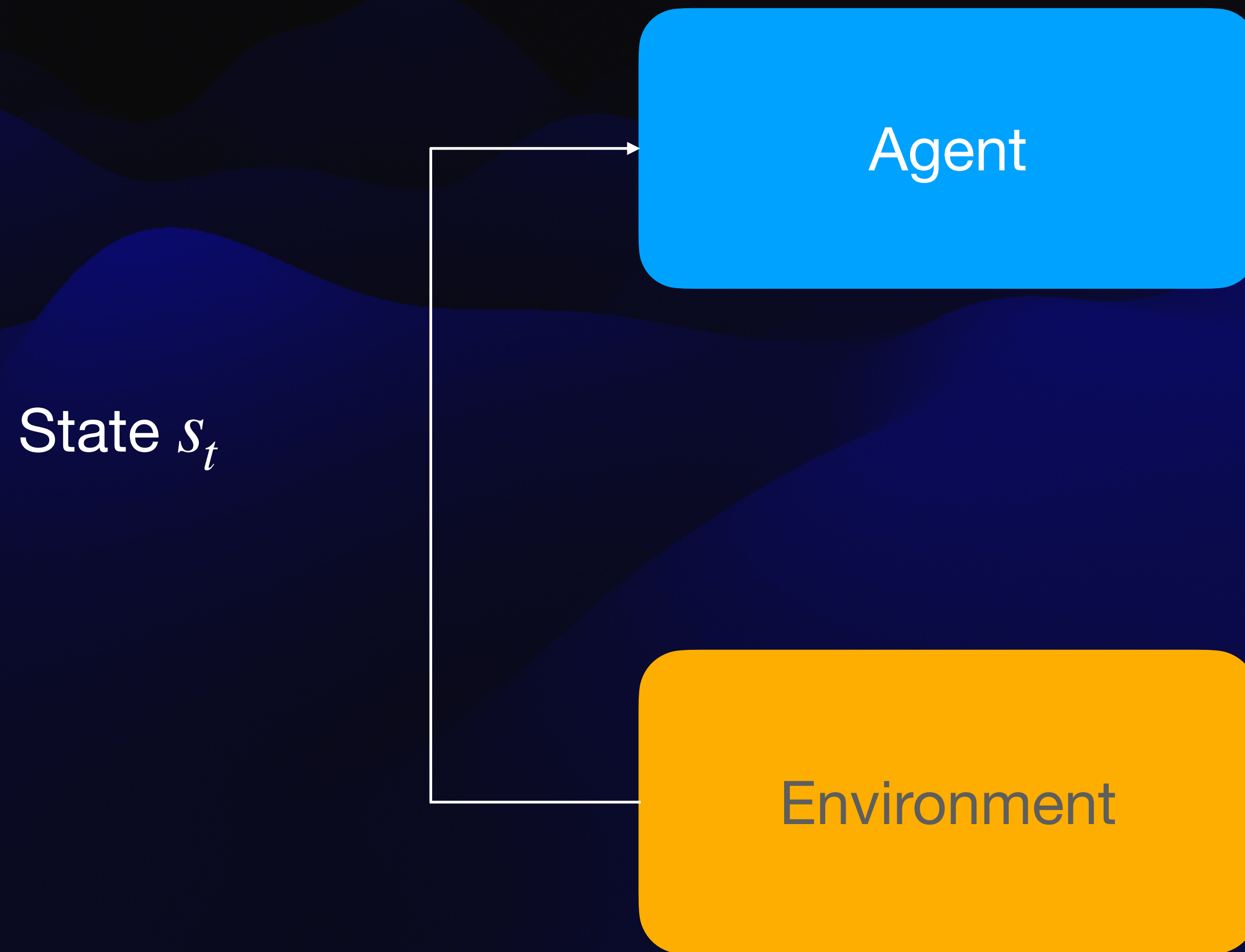
The diagram illustrates the core components of Reinforcement Learning. It features two rounded rectangular boxes: a blue one labeled 'Agent' positioned above a yellow one labeled 'Environment'. The background consists of dark blue, wavy, mountain-like shapes.

Agent

Environment

Reinforcement Learning

Main Idea



Reinforcement Learning

Main Idea



Reinforcement Learning

Main Idea



Reinforcement Learning

Main Idea







Reinforcement Learning

RL vs Deep RL

The background of the slide features a series of overlapping, wavy shapes in shades of dark blue and black, creating a layered, mountain-like or wave-like effect. The shapes are positioned in the lower half of the frame, leaving the upper half mostly black.

Reinforcement Learning

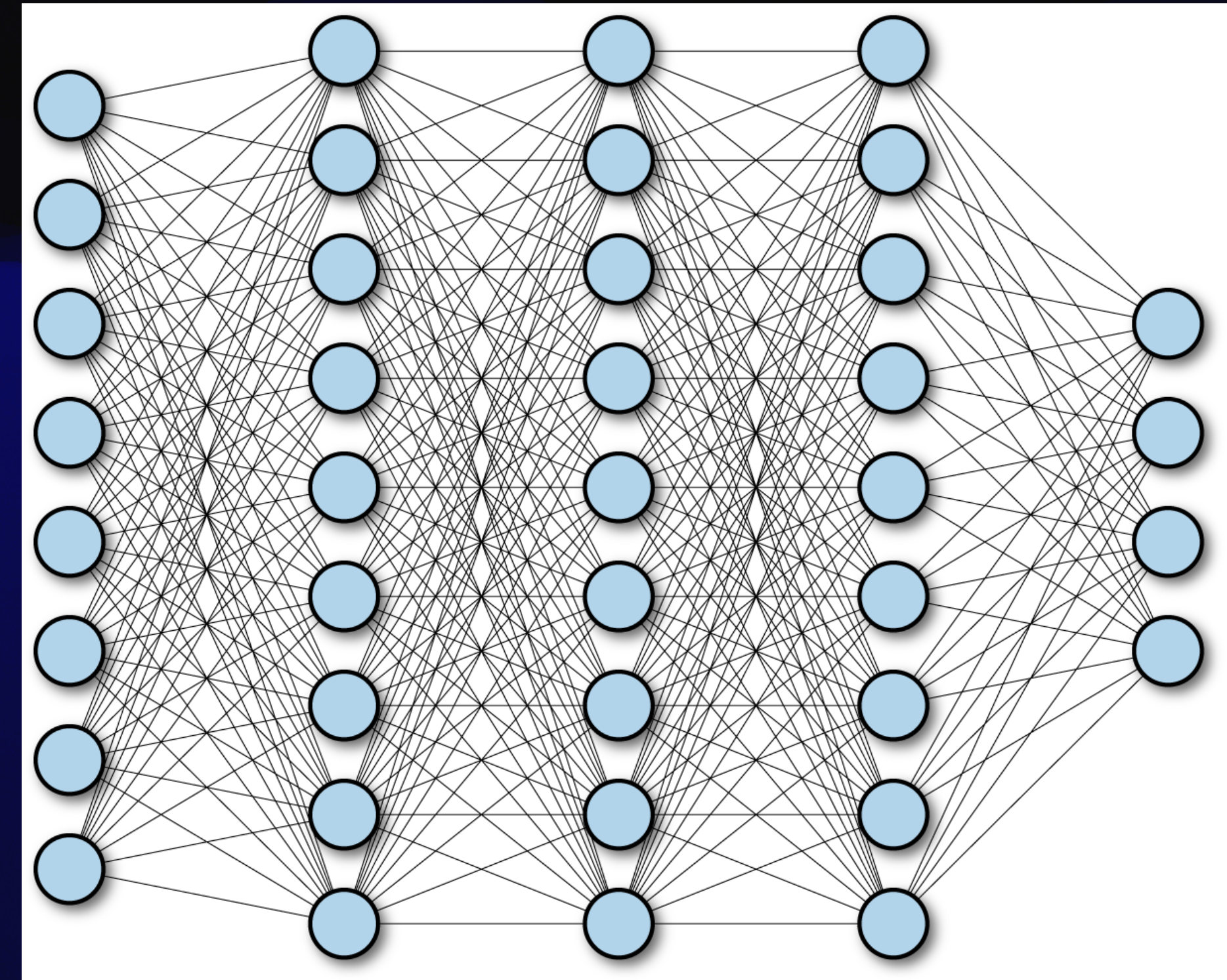
RL vs Deep RL

				
Start	0	0	0	0
Idle	0	0	0	0
Hole	0	0	0	0
End	0	0	0	0

Reinforcement Learning

RL vs Deep RL

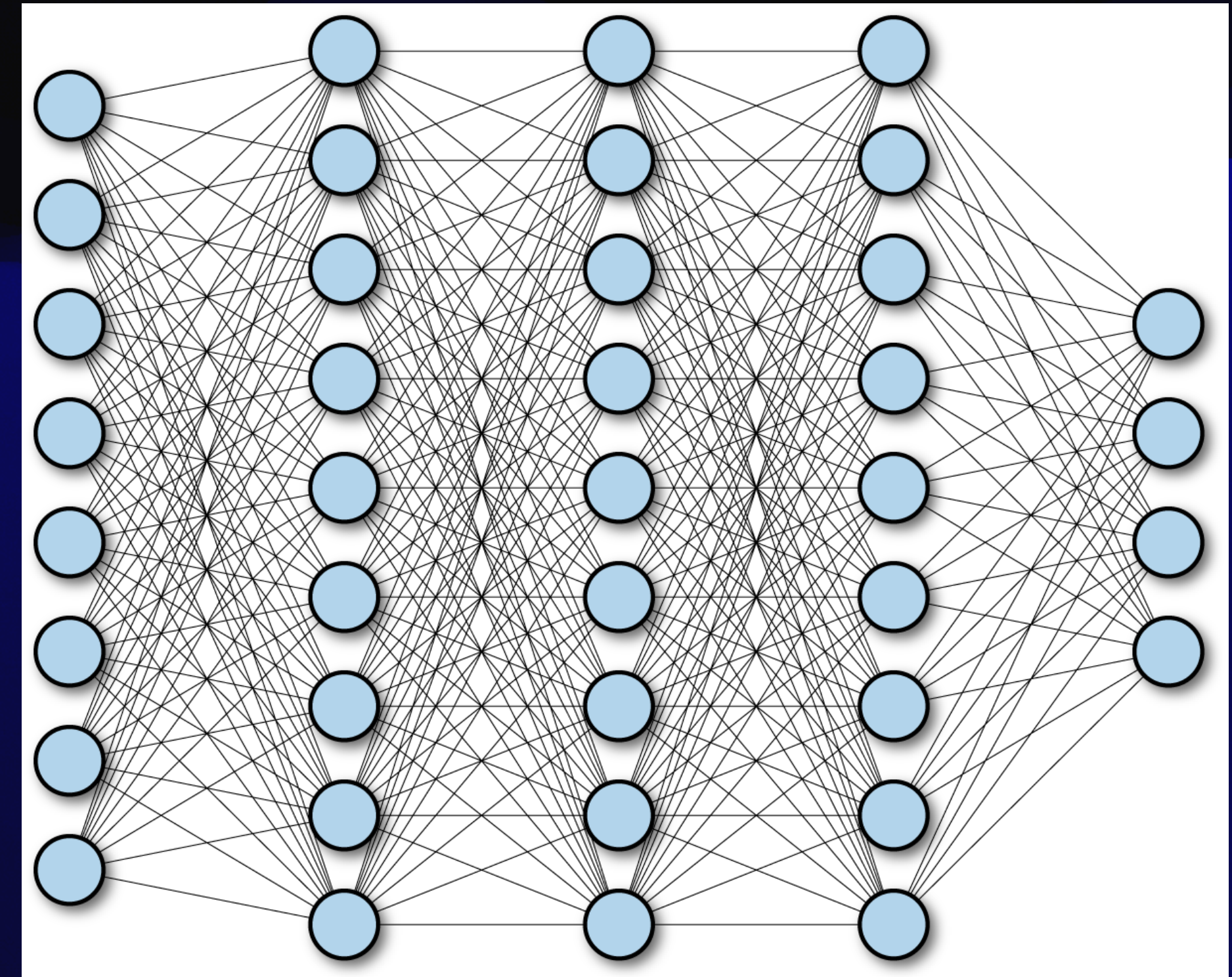
	➡	➡	⬆	⬇
Start	0	0	0	0
Idle	0	0	0	0
Hole	0	0	0	0
End	0	0	0	0



Reinforcement Learning

RL vs Deep RL

Start	0		0
Idle	0	0	0
Hole			0
End	0		0



How can deep RL be used in
knot theory?

Deep RL and Knot Theory

The background of the slide features a series of overlapping, wavy, horizontal bands. The top band is a very dark blue, almost black. Below it are several layers of lighter blue waves, creating a sense of depth and movement. The bottom-most band is a solid, vibrant blue. The overall effect is a modern, abstract, and layered aesthetic.

Deep RL and Knot Theory

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Deep RL and Knot Theory

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- Currently no closed form solution to find 4D slice genus...

Deep RL and Knot Theory

- Knots have things called “invariants”
- One invariant is 4D slice genus
- Currently no closed form solution to find 4D slice genus...
- What if deep RL can help us?

Deep RL and Knot Theory

Chosen Action: 0
Action 8: Remove r2



Interested in More?



Interested in More?

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Interested in More?

Blog Posts



Paper

