Transfer and Meta-Learning

~~Imitation and Inverse Reinforcement~~ Learning

- **Last time:**
  - Imitation Learning
  - Inverse Reinforcement Learning
- **Today:**

(Lecture content from Sergey Levine's CS 285 at Berkeley)

Imitation and Inverse Reinforcement Learning

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- **Today:**
  - How do we **transfer** knowledge from one domain to another? (e.g. simulated to real-world)

(Lecture content from Sergey Levine's CS 285 at Berkeley)

Imitation and Inverse Reinforcement Learning

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  - Imitation Learning
  - Inverse Reinforcement Learning
- **Today:**
  - How do we **transfer** knowledge from one domain to another? (e.g. simulated to real-world)
  - How do we learn how to learn? (**Meta** learning)

(Lecture content from Sergey Levine's CS 285 at Berkeley)

Transfer Learning and Montezuma's Revenge

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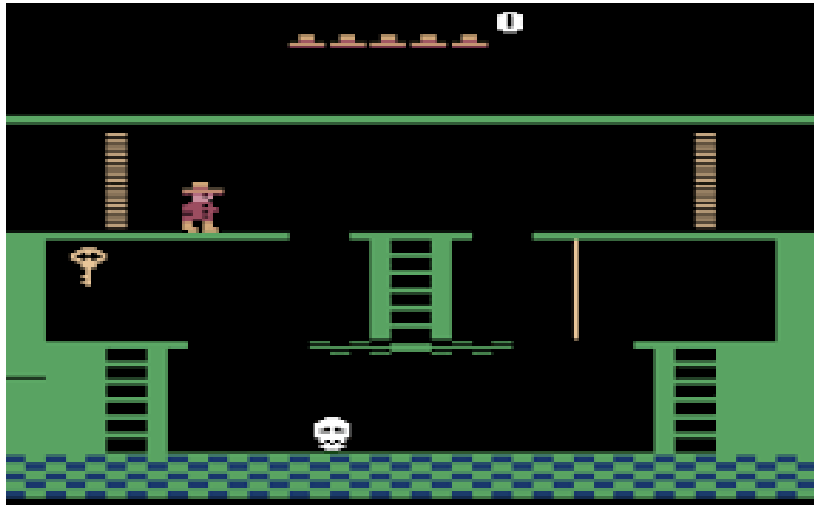

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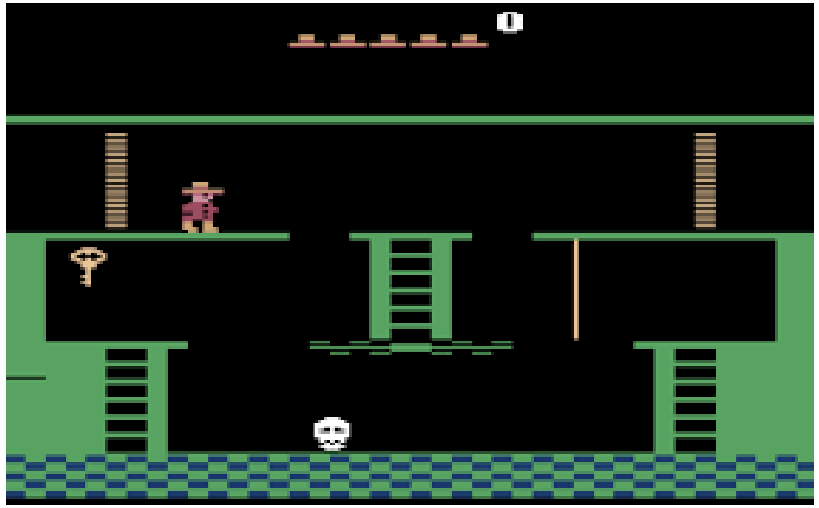

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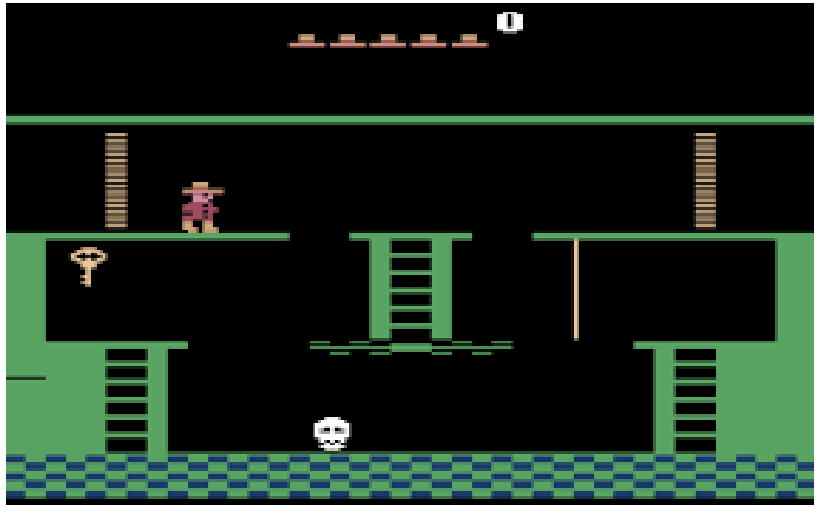

Could an RL agent be better at Montezuma's revenge after watching Indiana Jones?

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Source domain $\rightarrow$ target domain

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In RL, task=MDP

Source domain $\rightarrow$ target domain

- "shot" = number of attempts in the target domain
- "0-shot" = run policy in target domain
- "1-shot" = try task once
- "few shot"

Transfer Learning

How should prior knowledge be stored?

- Q-function
- Policy
- Model
- Features/hidden states

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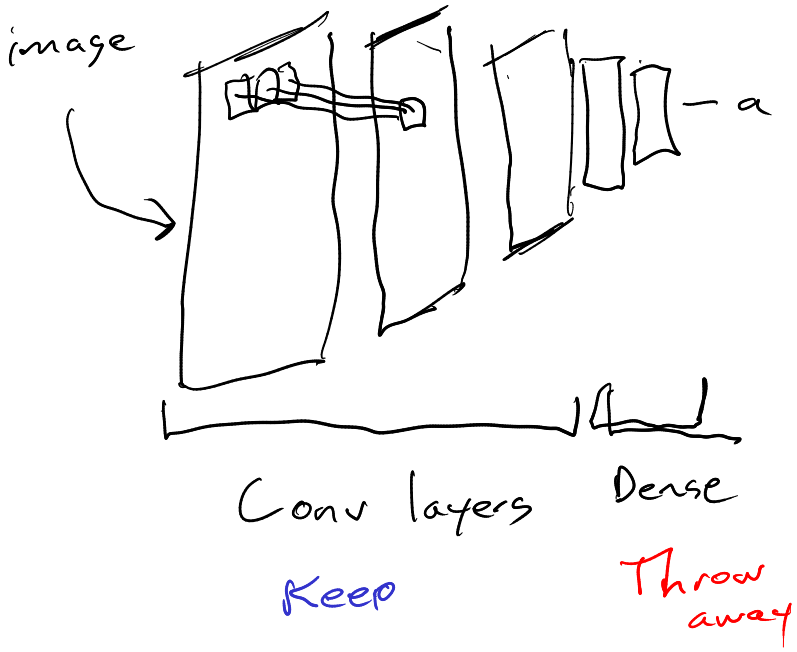
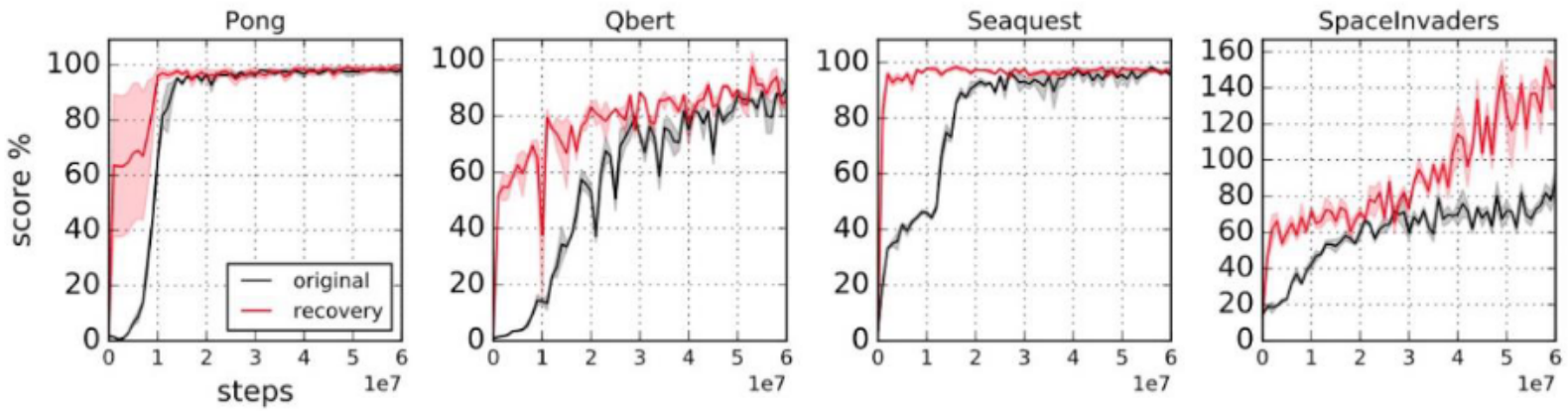
Representation Bottleneck





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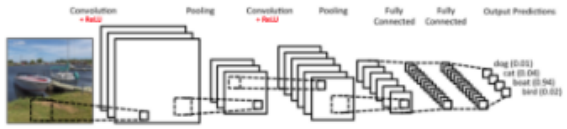
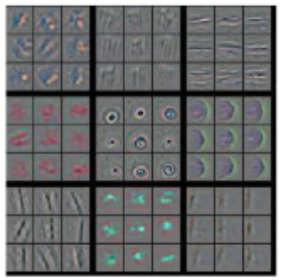
Pretraining + Finetuning

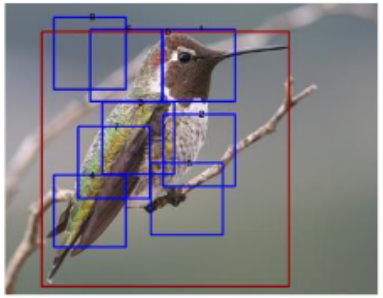
General Data

Domain-Specific Data

IMAGENET







Pretraining + Finetuning

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Pretrain: reward speed in any direction

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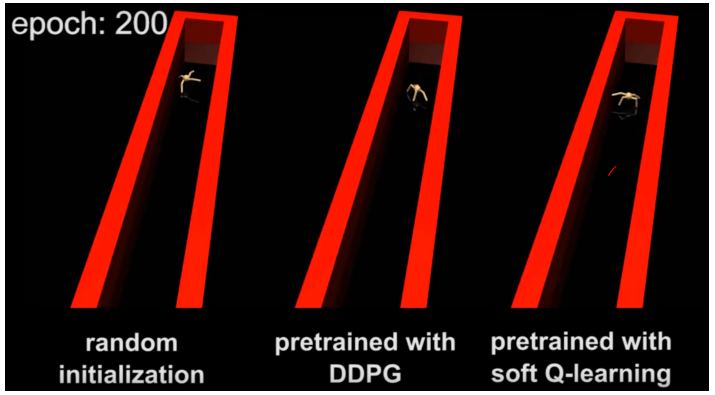

Fine Tune: reward speed in specific direction

Pretraining + Finetuning

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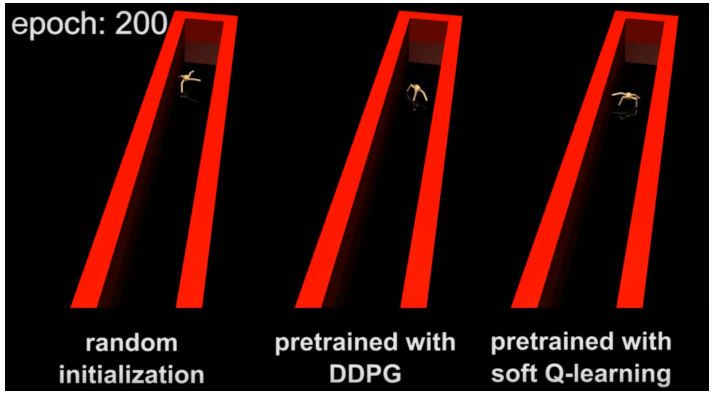


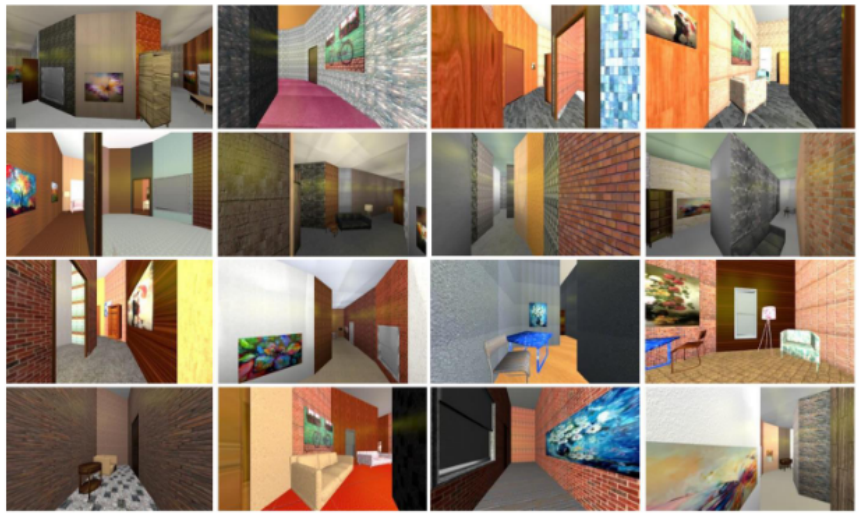
Fine Tune: reward speed in specific direction

softmax policy

$$\pi(a|s) \propto_a \exp(Q(s,a))$$

https://sites.google.com/view/softqlearning/home

CAD2RL



Key: Diversity

Actor Mimic

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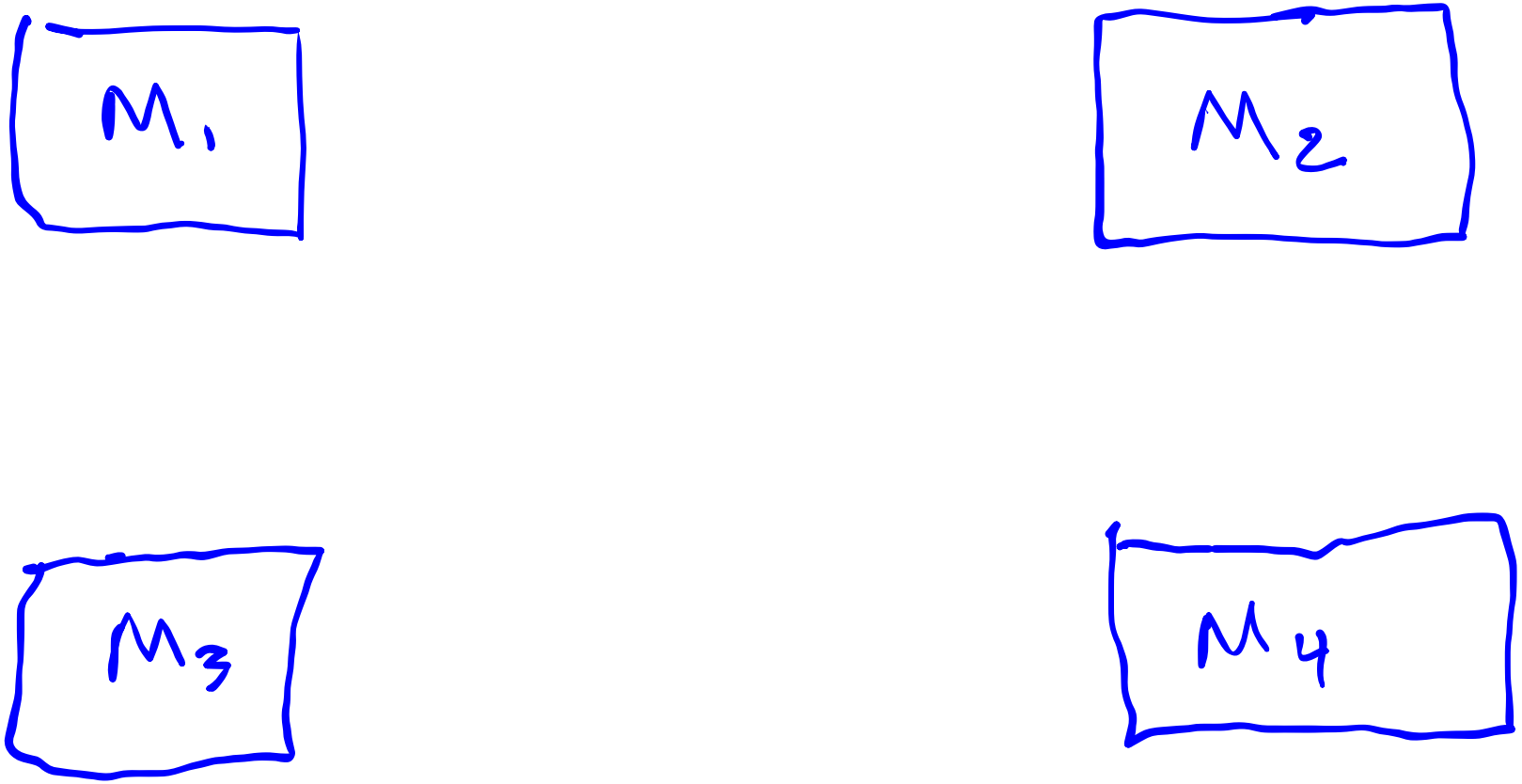

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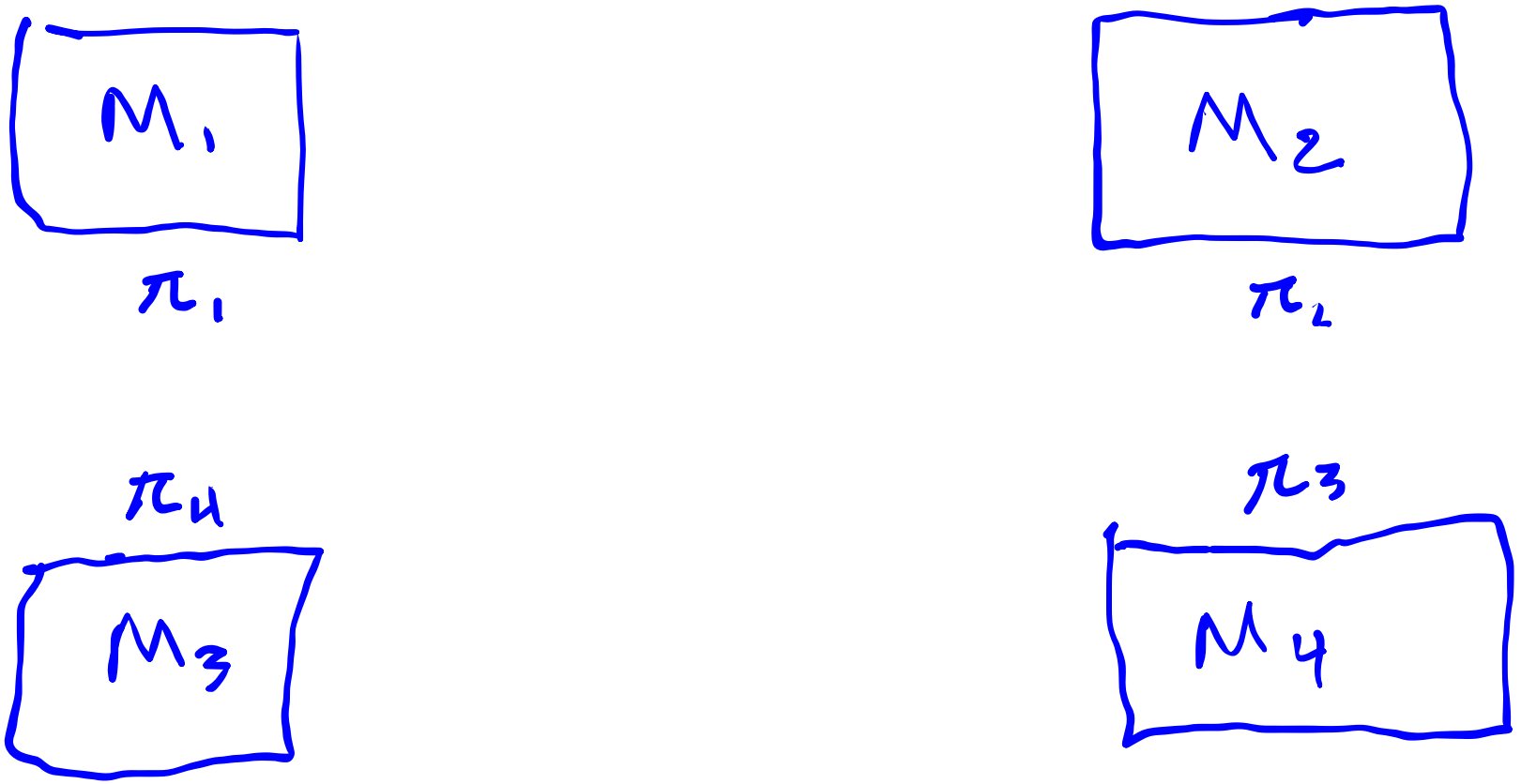

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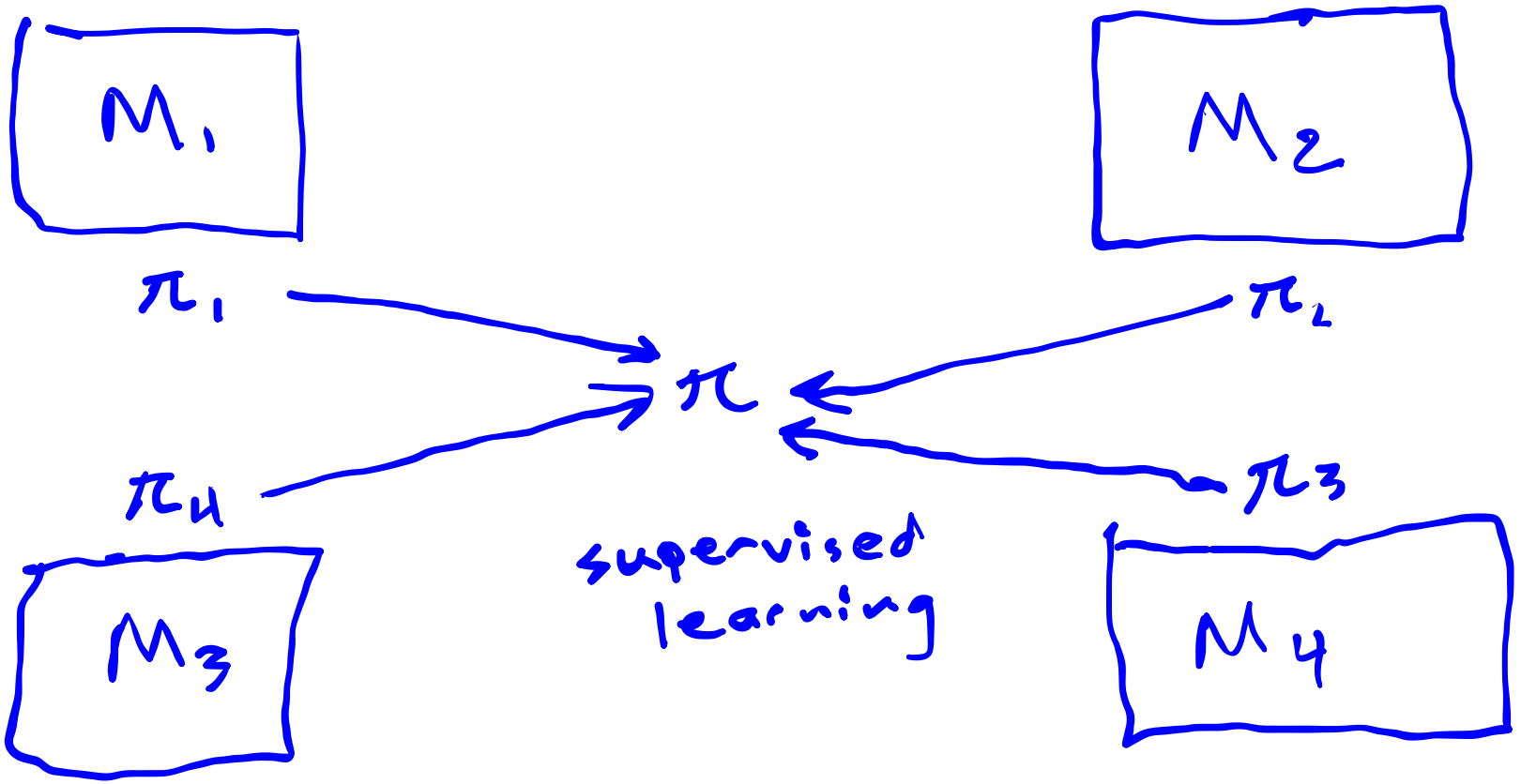

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Successor Features

All domains have same S, A, T, γ

Difference: R

Recall:

$$V^{\pi} = (I - \gamma T^{\pi})^{-1} R^{\pi}$$

Let \(R(s, a) =