Artificial Curiosity: Intrinsic motivation in machines too!

Women++ Webinar

23.09.2020

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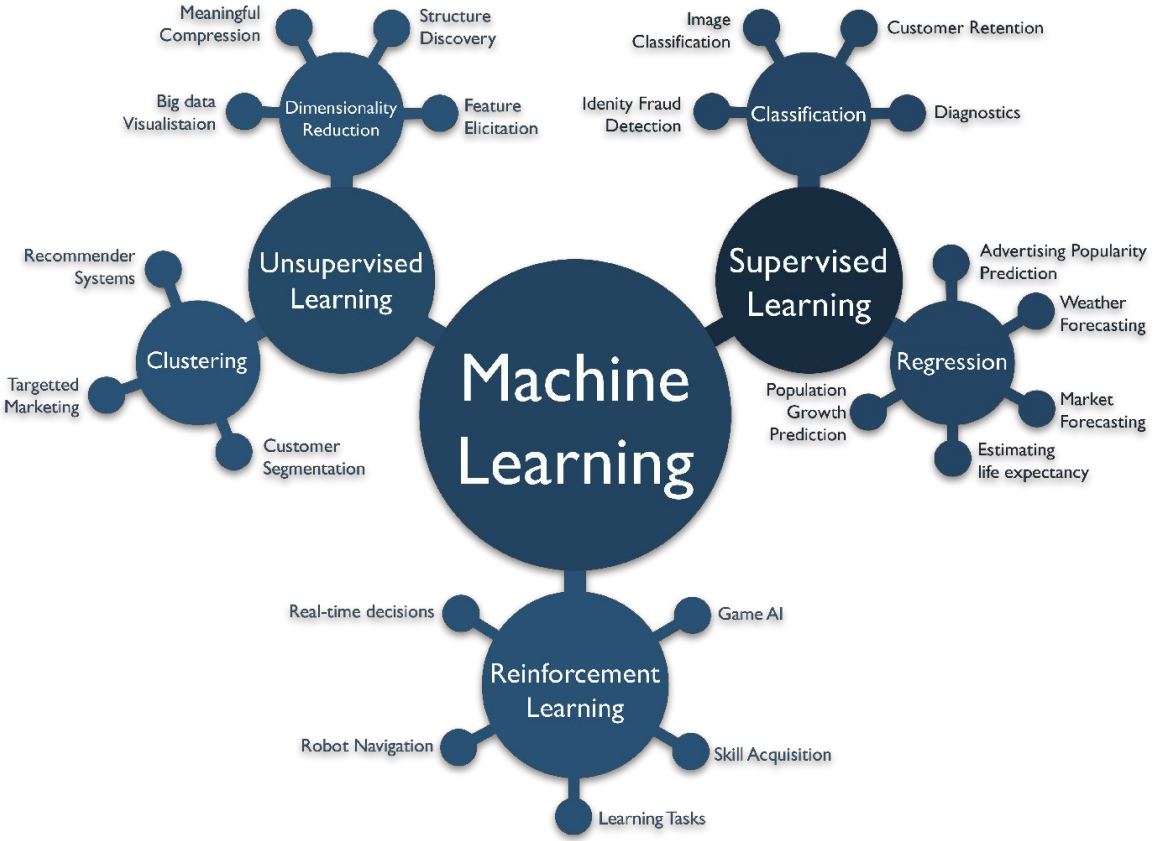
Three main areas of Machine Learning



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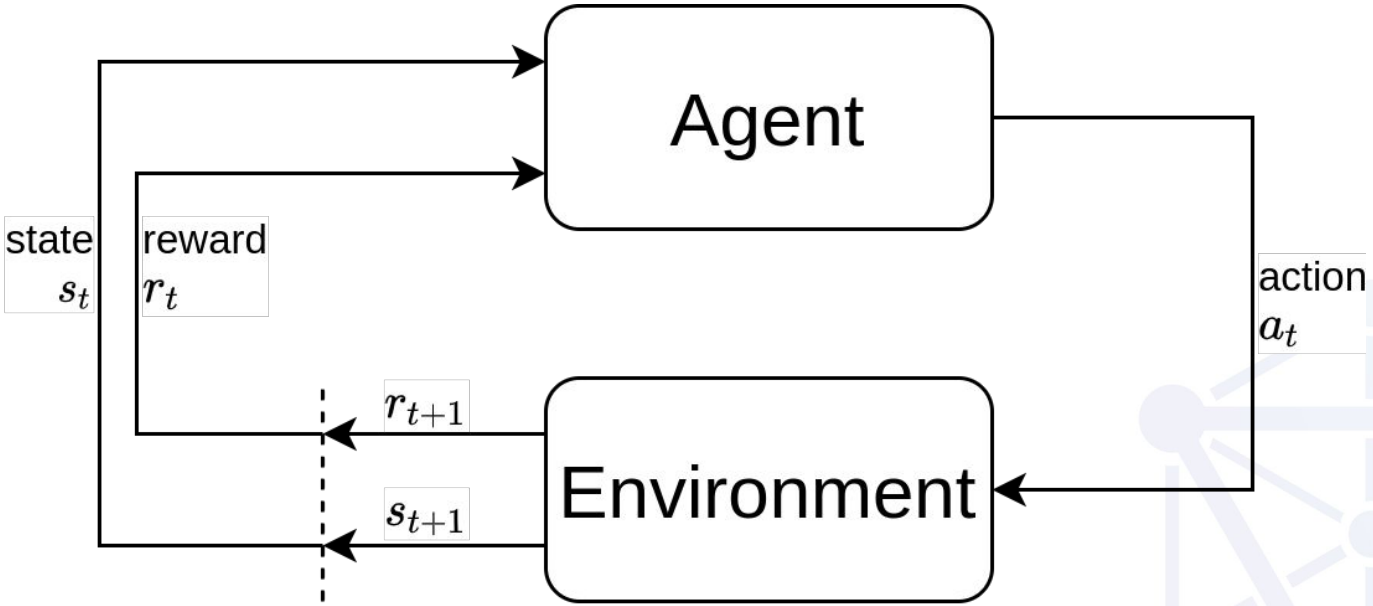
Reinforcement Learning



Objective: select actions that maximize the cumulated rewards:

$$R_t = r_{t+1} + r_{t+2} + r_{t+2} + \cdots + r_T$$

It is a me, Mario!

Coding time!

https://github.com/VisiumCH/women-plus-plus

README.md

Artificial Curiosity

This repository contains the code and models for the Artificial Curiosity Visium webinar with Women++.

Open the Workshop in Google Colab

To run the notebook in Colab, click here -> 

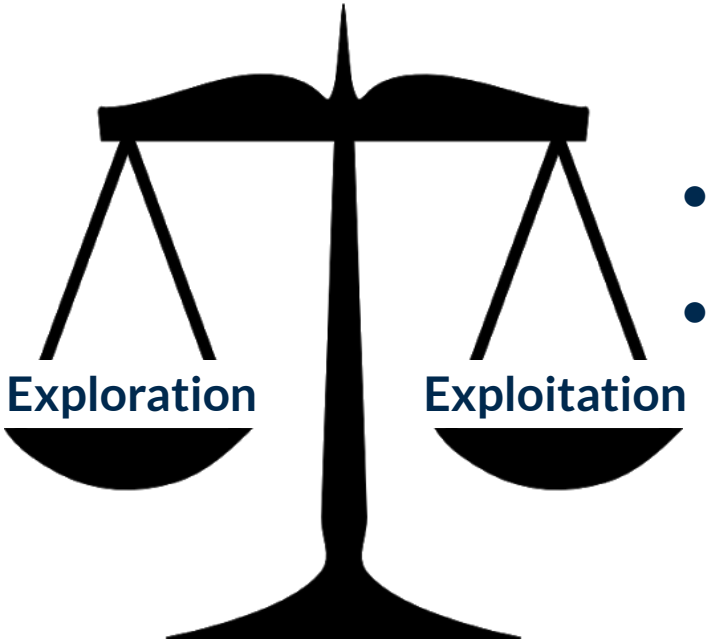
To see the output without running it, click here -> 

Not only in games!

Exploration vs Exploitation tradeoff

Systems that can take actions can adversely affect future data

- Goal: Learn more about what is good and bad
- Strategy: act randomly

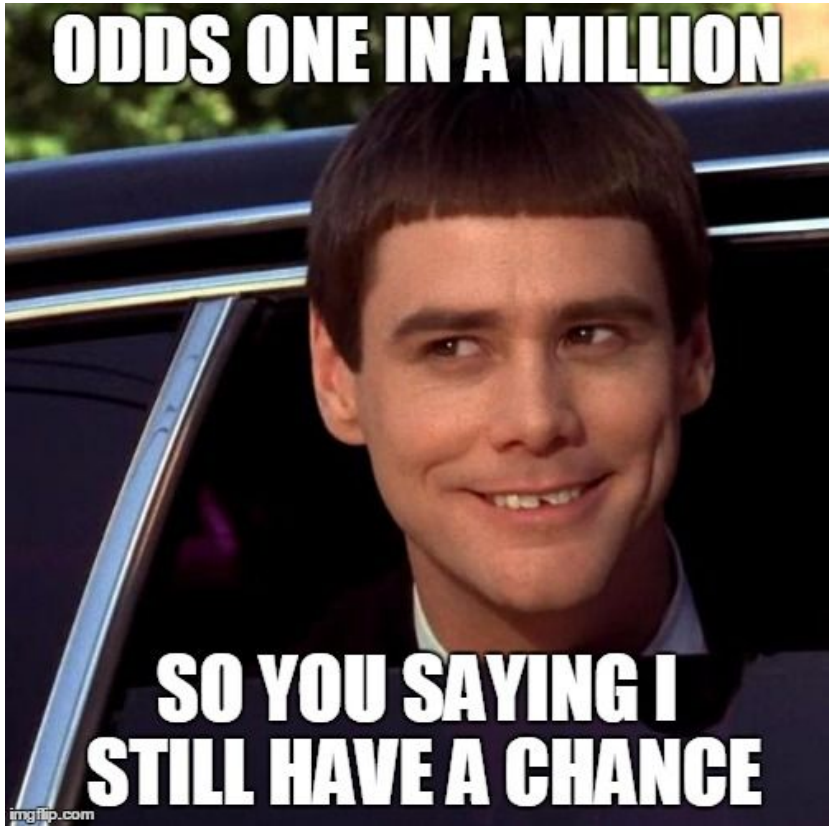


- Goal: Apply what has been learned when exploring
- Strategy: choose the action believed to be the best

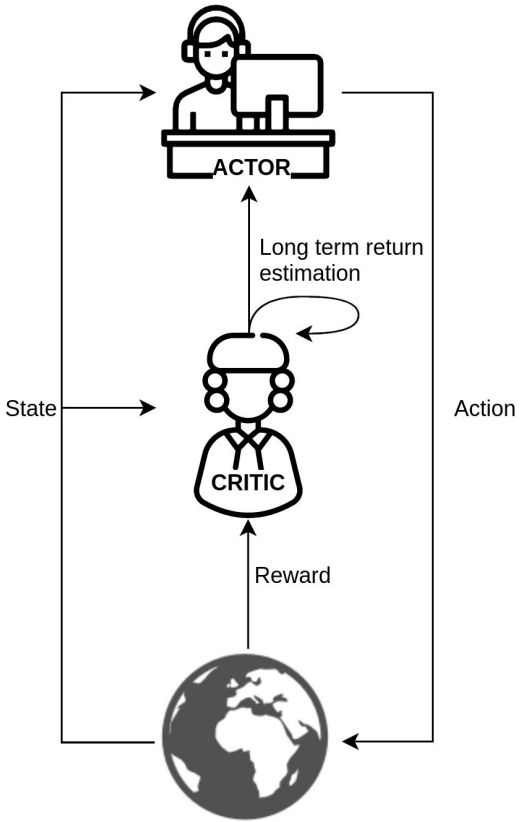
The Problem of Exploitation

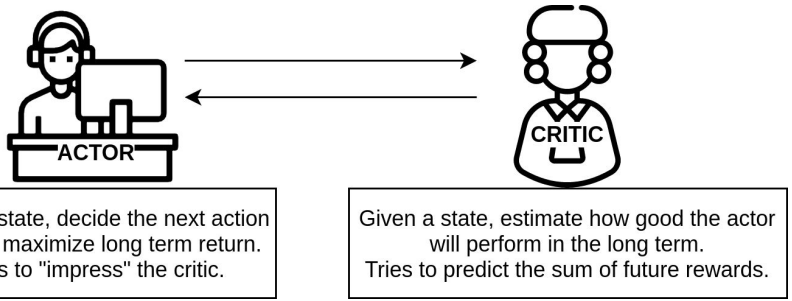
The Problem of Exploitation

Sparse Reward Problem



Actor-Critic Architecture





Extrinsic vs Intrinsic Motivation

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Surprise as a proxy for curiosity

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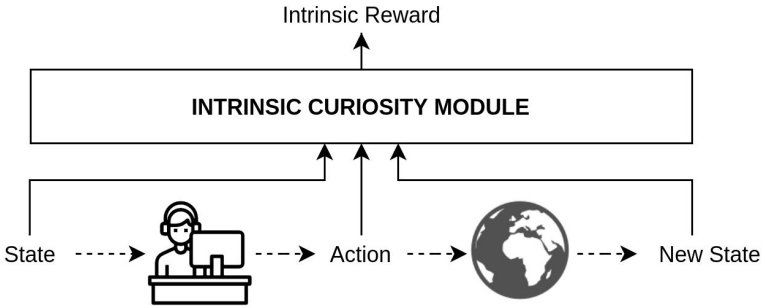
Curious Reinforcement Learning

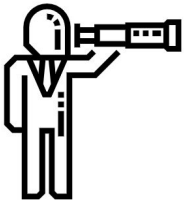


FEATURES EXTRACTOR

Given a state, extracts information that is useful for the forward and inverse models.

INVERSE MODEL

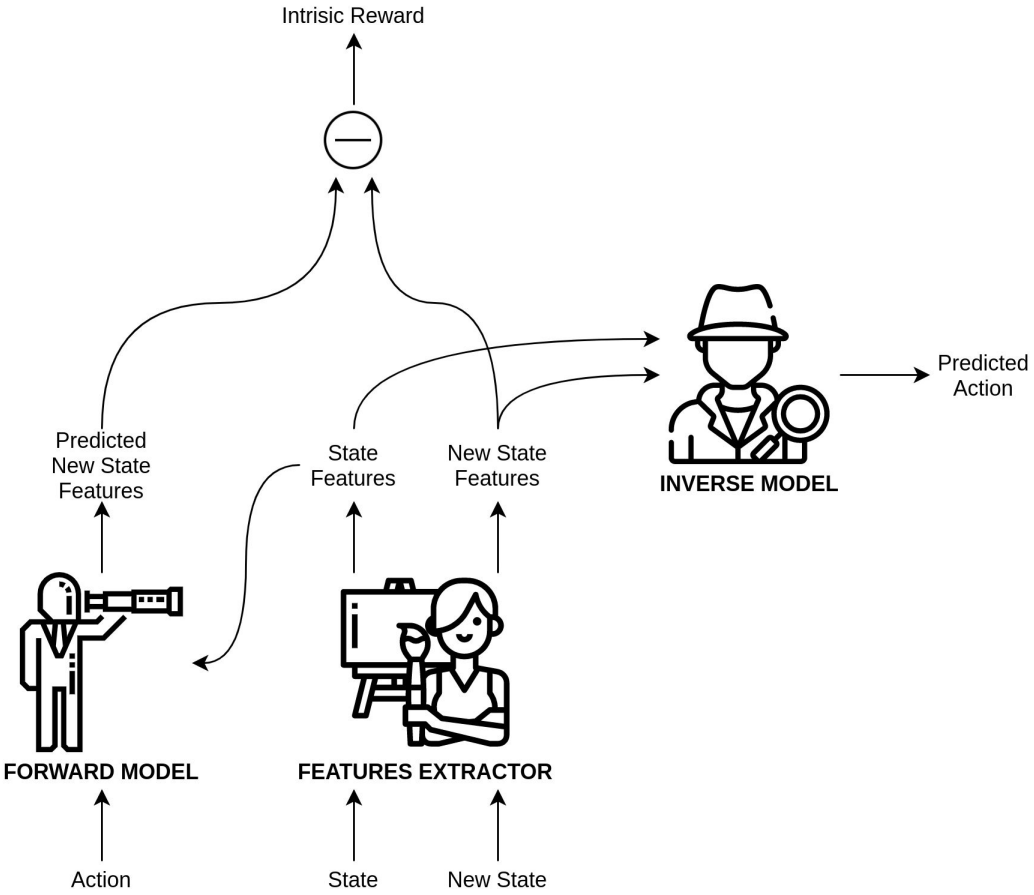
Given state and next state features, predicts what action was taken in between.
Encourages the feature extractor to focus on elements the agent can impact.



FORWARD MODEL

Given state features and an action, predicts what the next state features will be.
Its error is the intrinsic motivation: the agent is curious about unexpected states.

Curious Reinforcement Learning



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Curious Reinforcement Learning

- No need to implement a reward
- Use a non-sparse reward function
- Learn the exploration strategy automatically
- Learn a model of the environment
- Transfer to other environments

Couch Potato Problem

Burda et al., “Large Scale Study of Curiosity-Driven Learning” (ICLR 2019)

Conclusions

- Reinforcement Learning has a certain aspect of *creativity* and can beat humans by finding new optimal solutions
- **But** it requires rewards and a reward function!
- Curious RL can be a solution to this problem
- But beware of the couch potato problem…

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