



# Machine Learning for Games

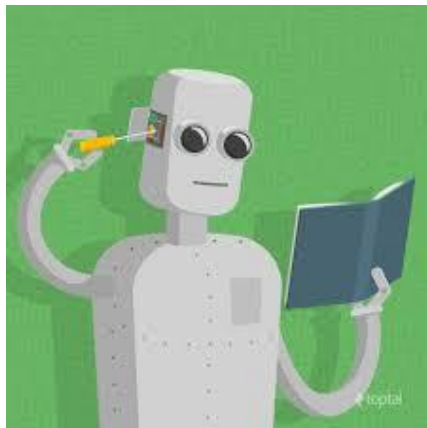
Niamh Donnelly



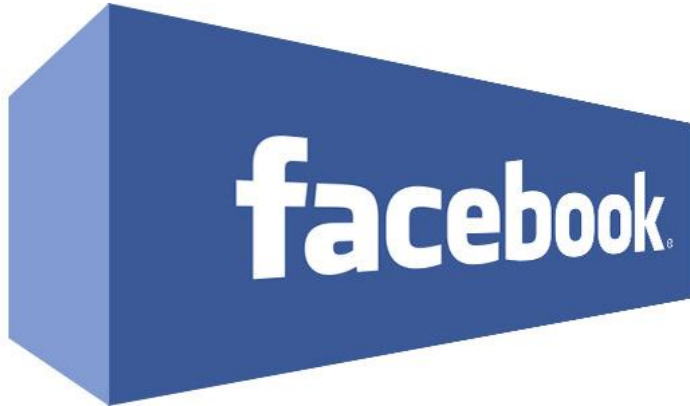
# Overview

- Applications of Machine Learning
- Two types of machine learning
  - Supervised Learning
  - Reinforcement Learning
- How these machine learning models can learn to play the Lunar Lander game

# What is Machine Learning ?



# Examples

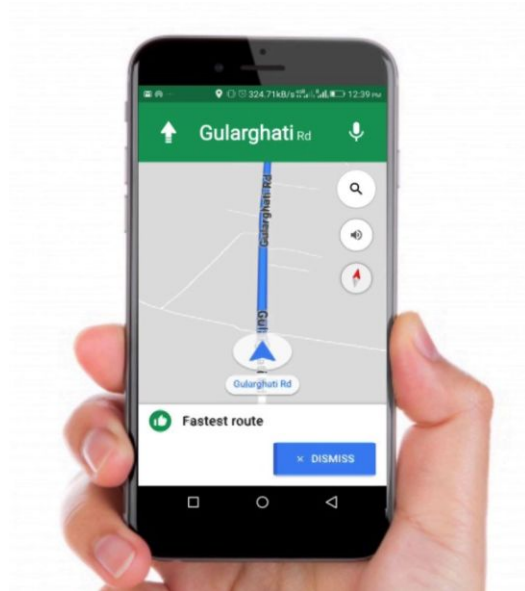


Automatic tagging  
friends faces



Friends Suggestions

# Google Maps



## Google Maps Fastest Route Feature

- Number of people who are currently using the service,
- Database of historical traffic data

# Robotics



Navigation



Communication



# Supervised Learning





# Supervised Learning

Training Data

<i><b>Example</b></i>	<i><b>Height</b></i>	<i><b>Width</b></i>	<i><b>Taste</b></i>	<i><b>Weight</b></i>	<i><b>Class</b></i>
1	60	62	Sweet	186	Apple
2	70	53	Sweet	180	Pear
3	55	50	Tart	152	Apple
4	76	40	Sweet	152	Pear
5	68	71	Tart	207	Orange
6	65	68	Sour	221	Apple
7	63	45	Sweet	140	Pear

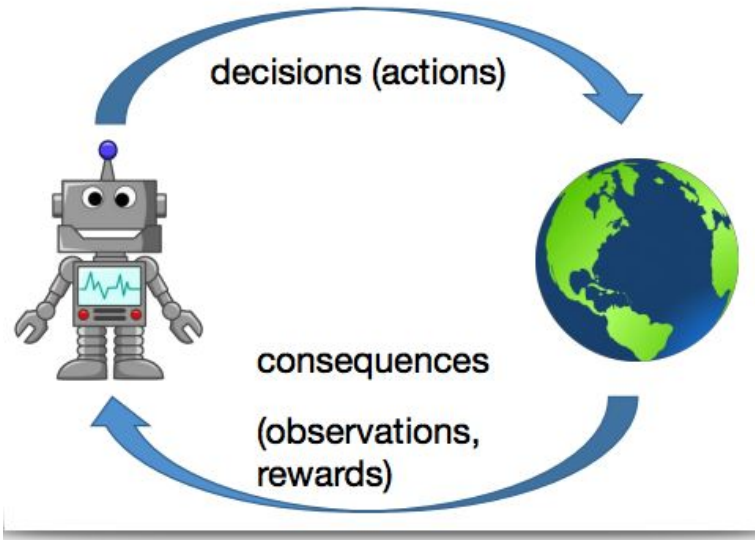




# What class does Example X belong to ?

<i><b>Example</b></i>	<i><b>Height</b></i>	<i><b>Width</b></i>	<i><b>Taste</b></i>	<i><b>Weight</b></i>	<i><b>Class</b></i>
<b>X</b>	63	68	Sweet	168	???

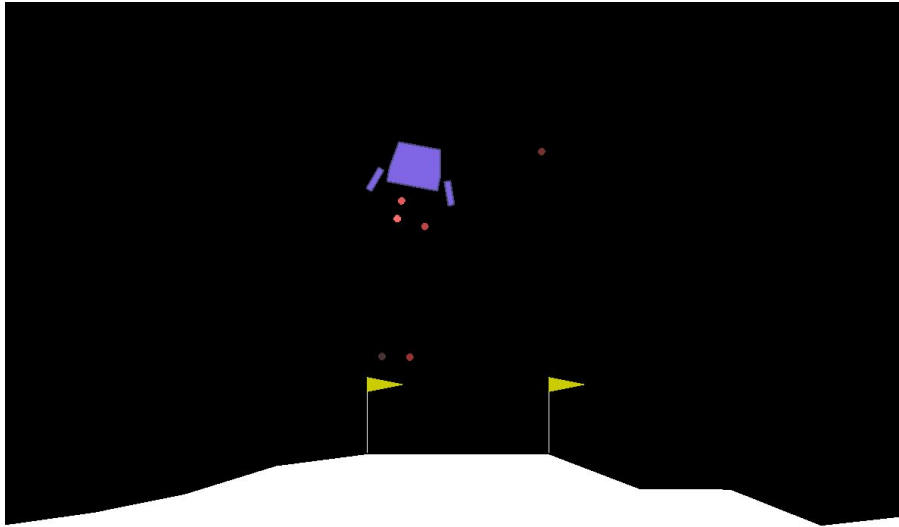
# Reinforcement Learning



- No data set
- Training involves trial and error
- Agent is given rewards for correct moves/decisions



# Lunar Lander Game



Aim:

Land between flags gently

Actions:

- Up
- Left
- Right
- Do nothing

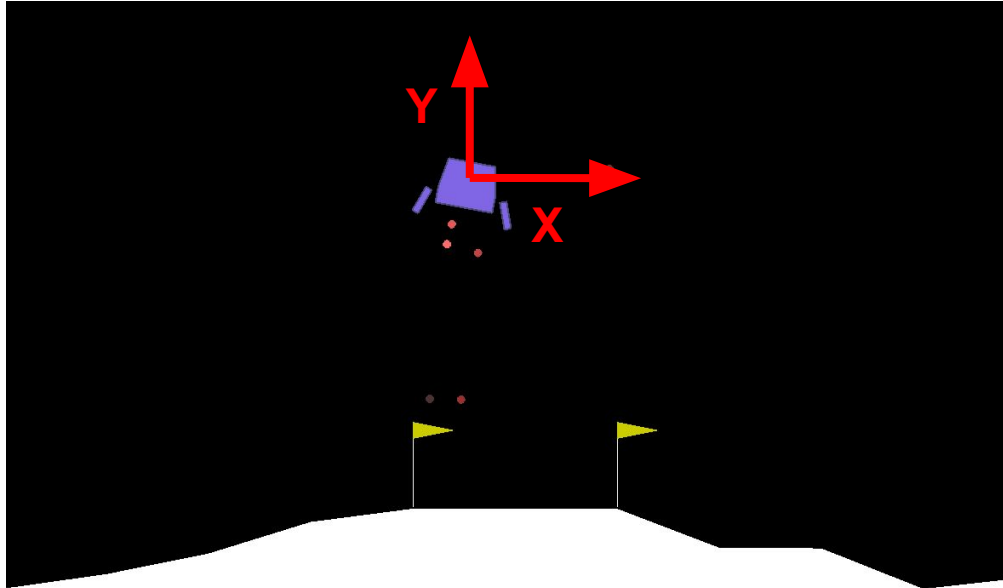


## Supervised Learning Model

Example	Position X	Position Y	Velocity X	Velocity Y	Ship Angle	Action
1	-0.004	0.937	-0.410	-0.215	0.004	Up
2	-0.008	0.933	-0.401	-0.240	0.007	Left
3	-0.011	0.929	-0.392	-0.267	0.008	Left
4	-0.015	0.925	-0.383	-0.293	0.007	Right
5	-0.019	0.920	-0.375	-0.319	0.005	Up

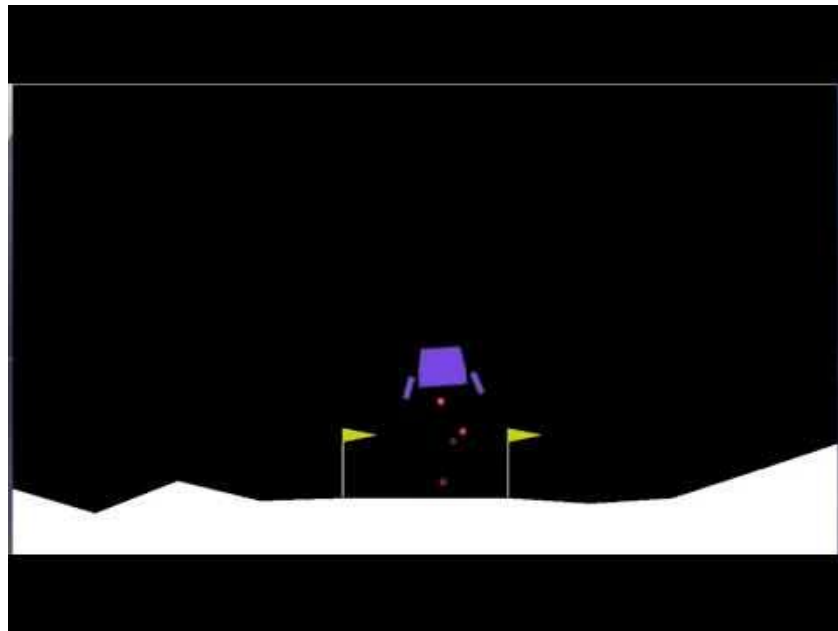


# Supervised Learning Model





## Supervised Learning player





# Reinforcement Learning

- No data set
- Starts the game by playing at random
- Receives feedback from the environment
- Agent updates its knowledge of the world based on that feedback

## Rewards Gain:

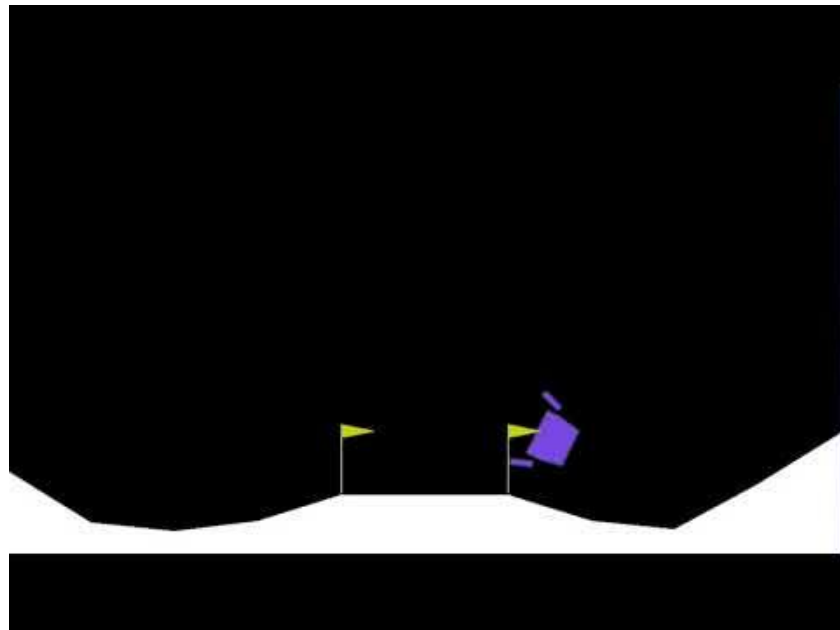
- How close to the flags the lander is
- How close to zero speed

## Loss

- Moving away from the flags
- Crashing



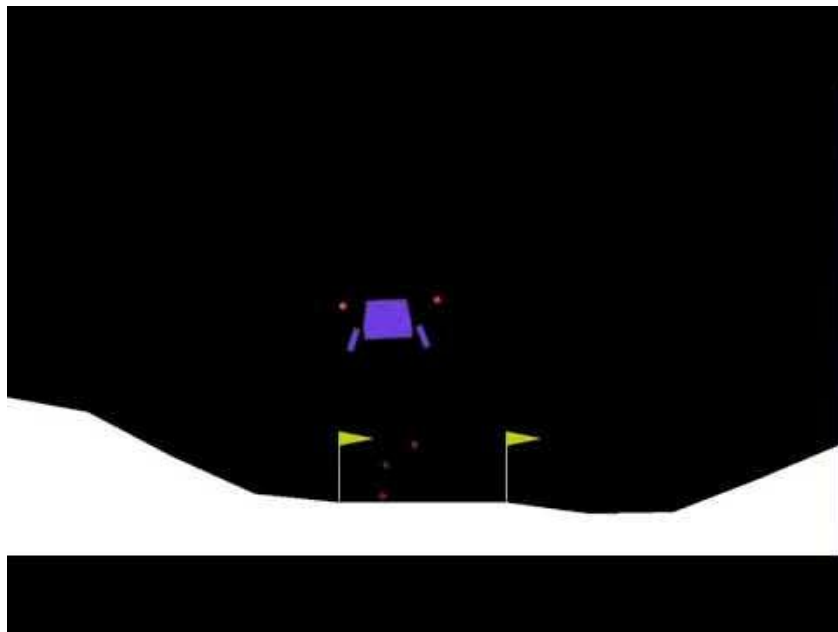
## Reinforcement Learning - Initial Training



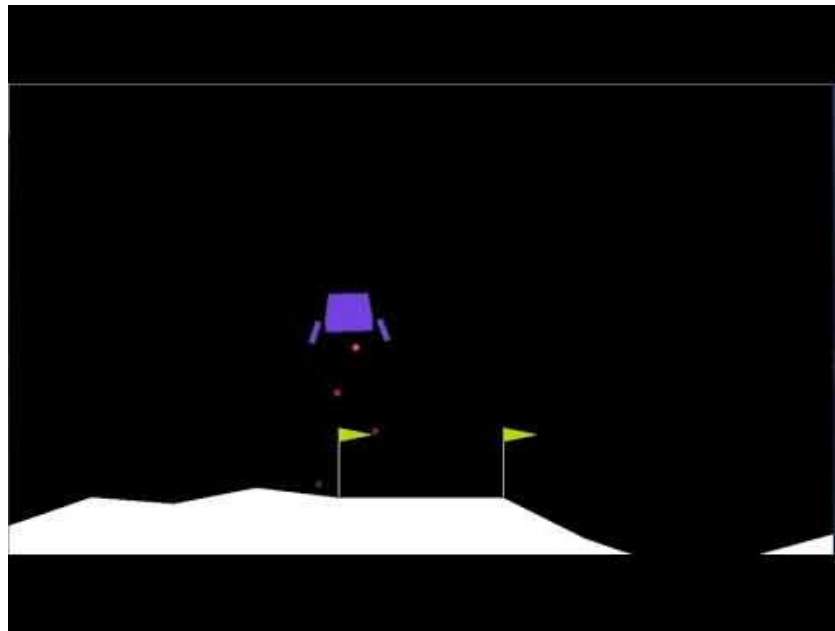




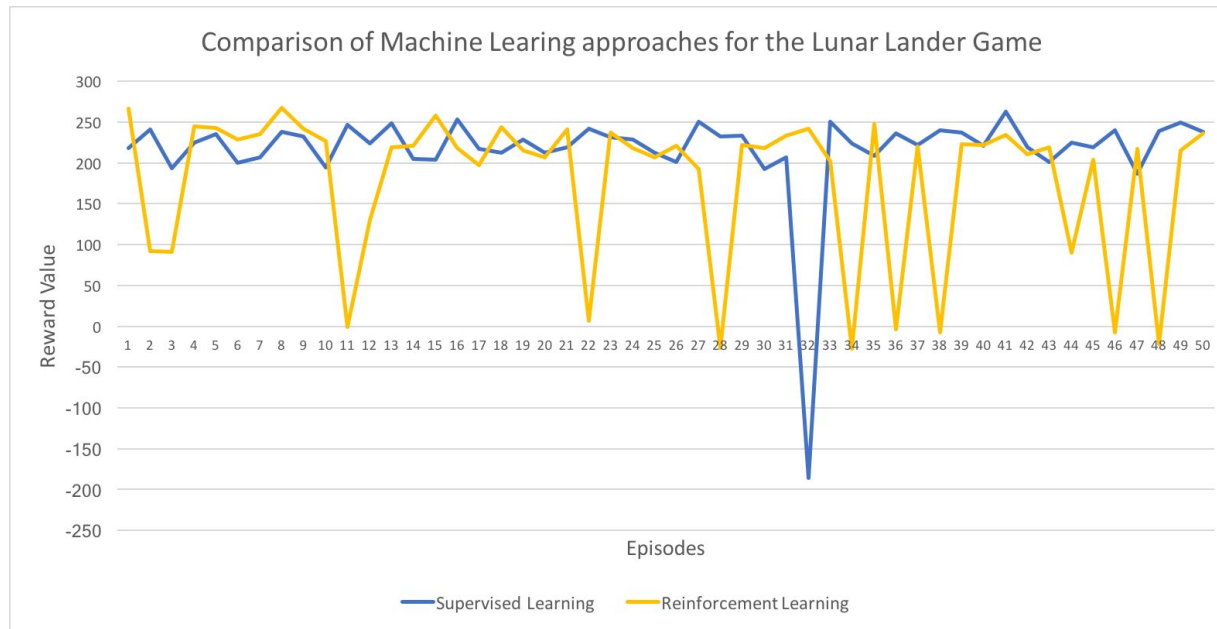
## Reinforcement Learning - 10000 Training Games



# Reinforcement Learning - 40000 Training Games



# Results



# Reinforcement learning use cases



**Robotics**

