

# Fundamentals of Machine Learning

## THREE SCHOOLS ACROSS FIVE TRIBES

finding correlation  
between input and output

supervised  
learning

discovering patterns  
between different inputs

unsupervised  
learning

reinforcement  
learning

developing behaviour of  
agent in environment

# Fundamentals of Machine Learning

## THREE SCHOOLS ACROSS FIVE TRIBES

finding correlation  
between input and output

supervised  
learning

discovering patterns  
between different inputs

unsupervised  
learning

reinforcement  
learning

developing behaviour of  
agent in environment

# Fundamentals of Machine Learning

## THREE SCHOOLS ACROSS FIVE TRIBES

finding correlation  
between input and output

supervised  
learning

discovering patterns  
between different inputs

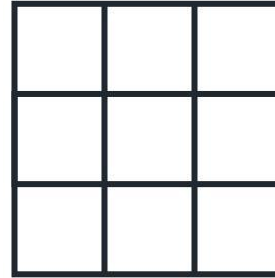
unsupervised  
learning

reinforcement  
learning

developing behaviour of  
“policy” in environment

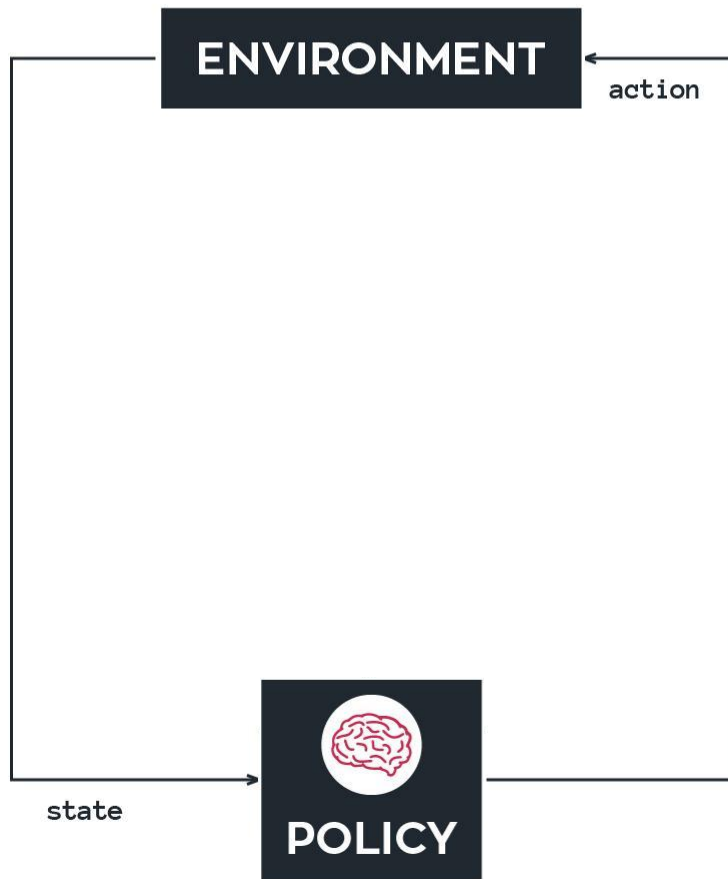
# Deep Q-Learning

OPPONENT [o]

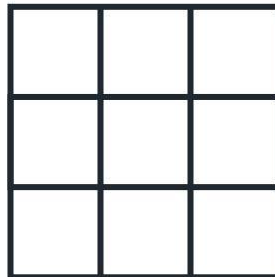


Q-LEARNING  
POLICY [x]

# Deep Q-Learning

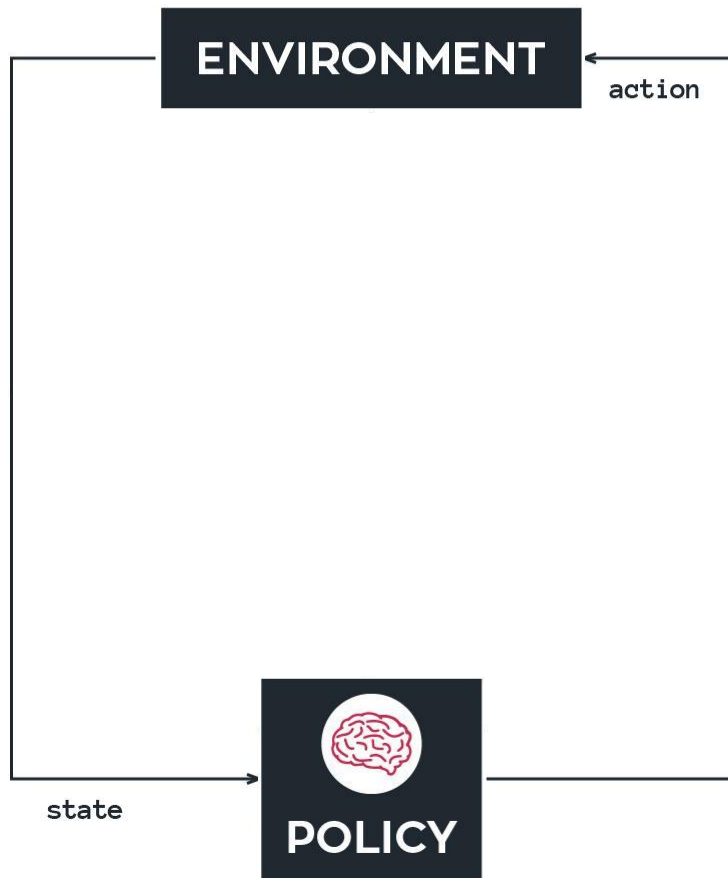


OPPONENT [o]

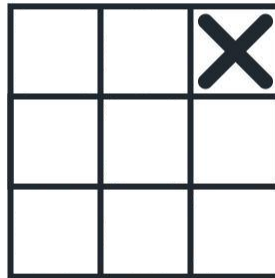


Q-LEARNING  
POLICY [x]

# Deep Q-Learning

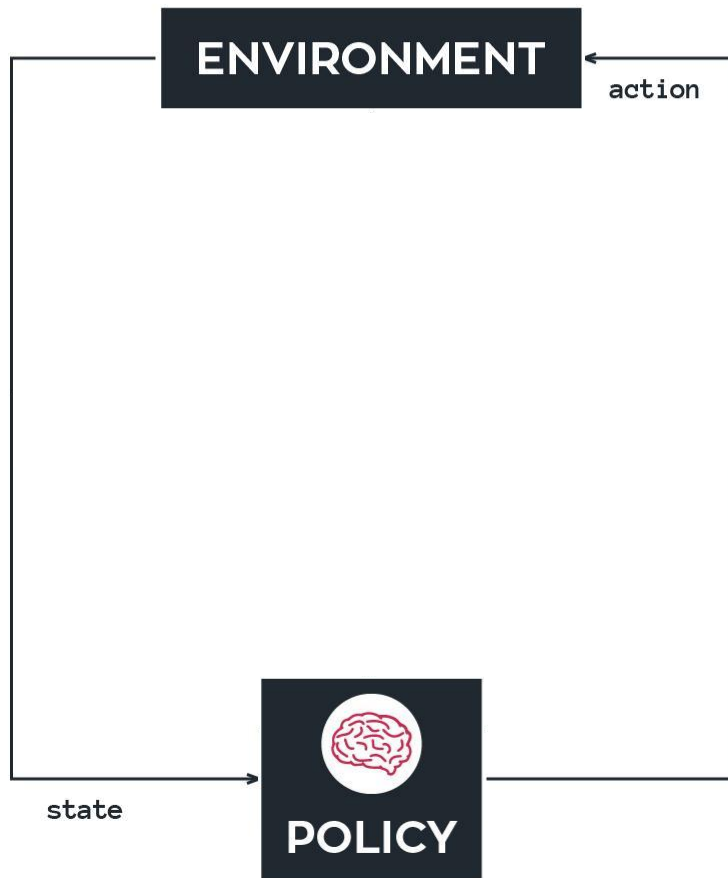


OPPONENT [o]

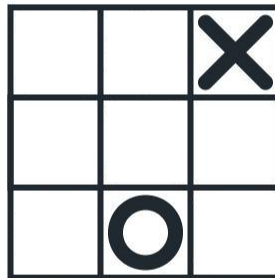


Q-LEARNING  
POLICY [x]

# Deep Q-Learning

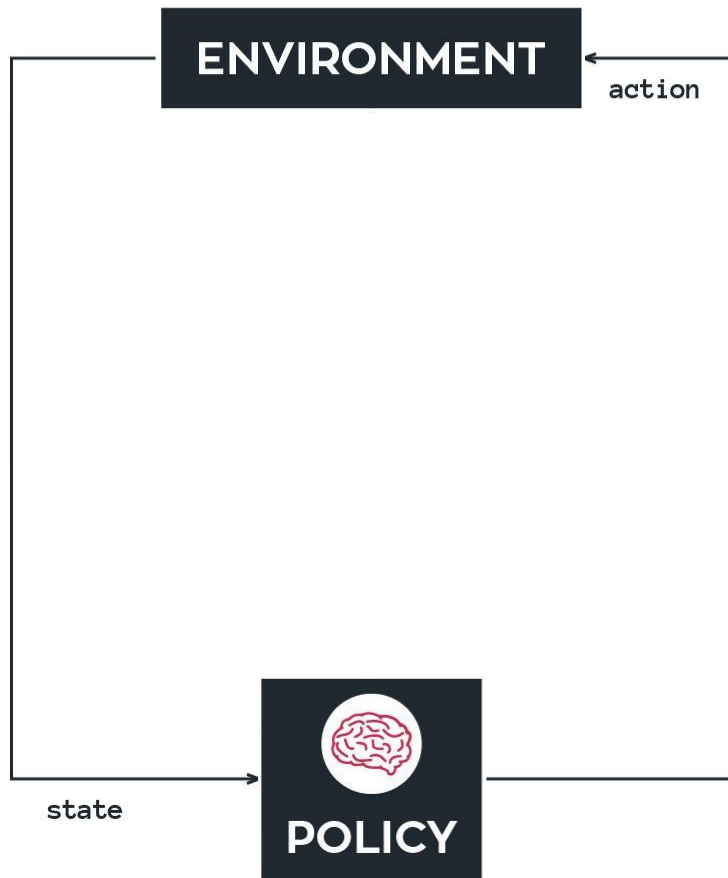


OPPONENT [o]

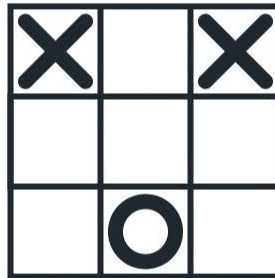


Q-LEARNING  
POLICY [x]

# Deep Q-Learning



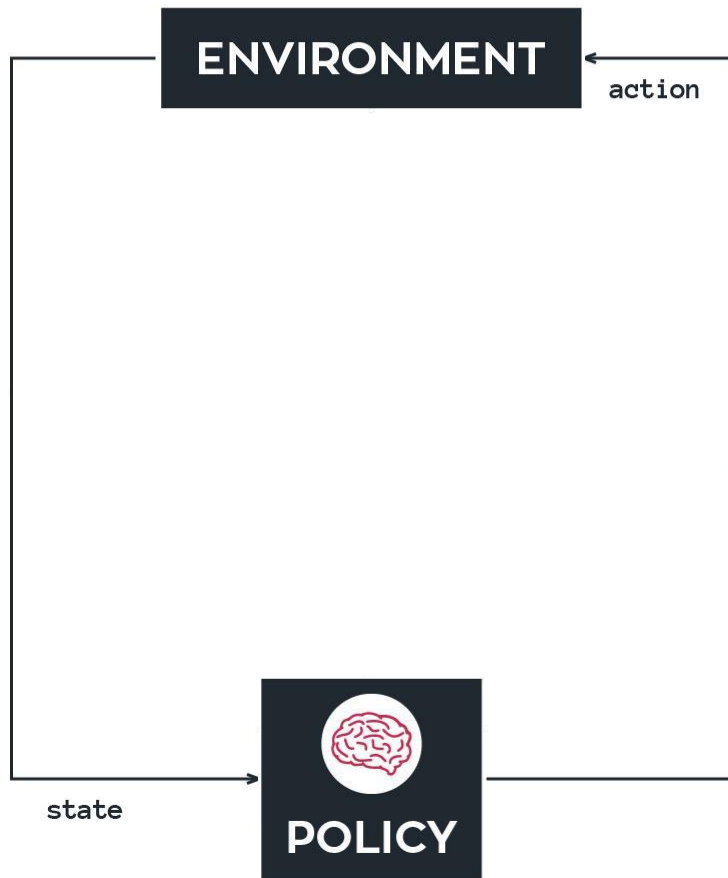
OPPONENT [o]



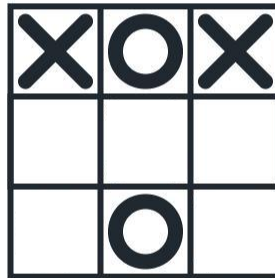
Q-LEARNING  
POLICY [x]



# Deep Q-Learning

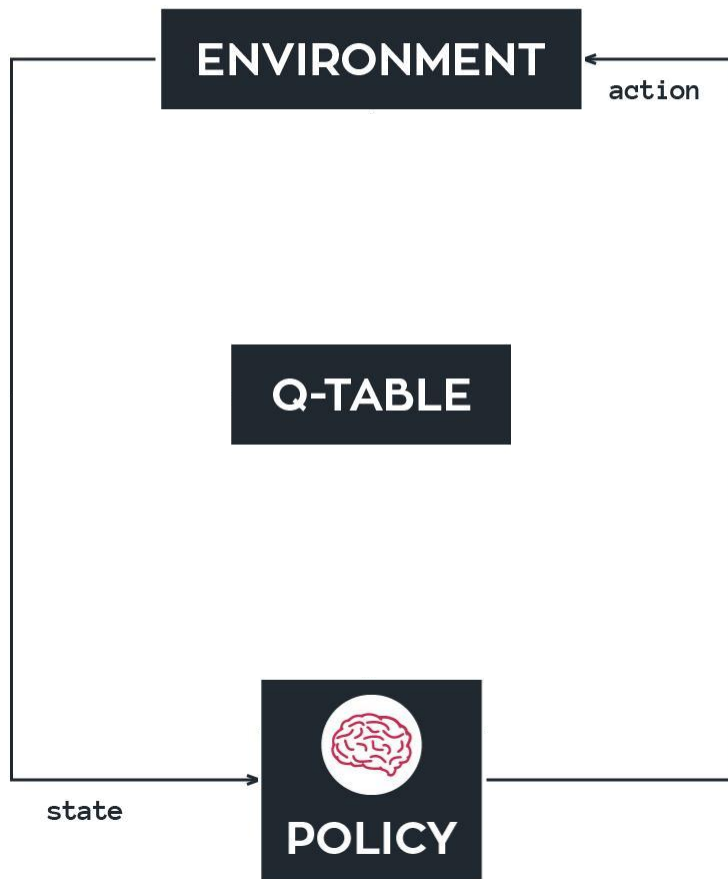


OPPONENT [o]

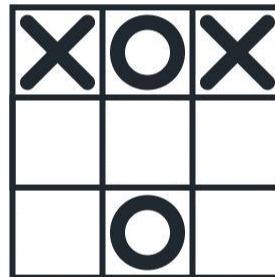


Q-LEARNING  
POLICY [x]

# Deep Q-Learning

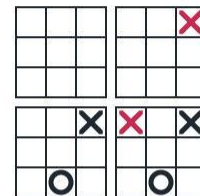


OPPONENT [o]



Q-LEARNING  
POLICY [x]

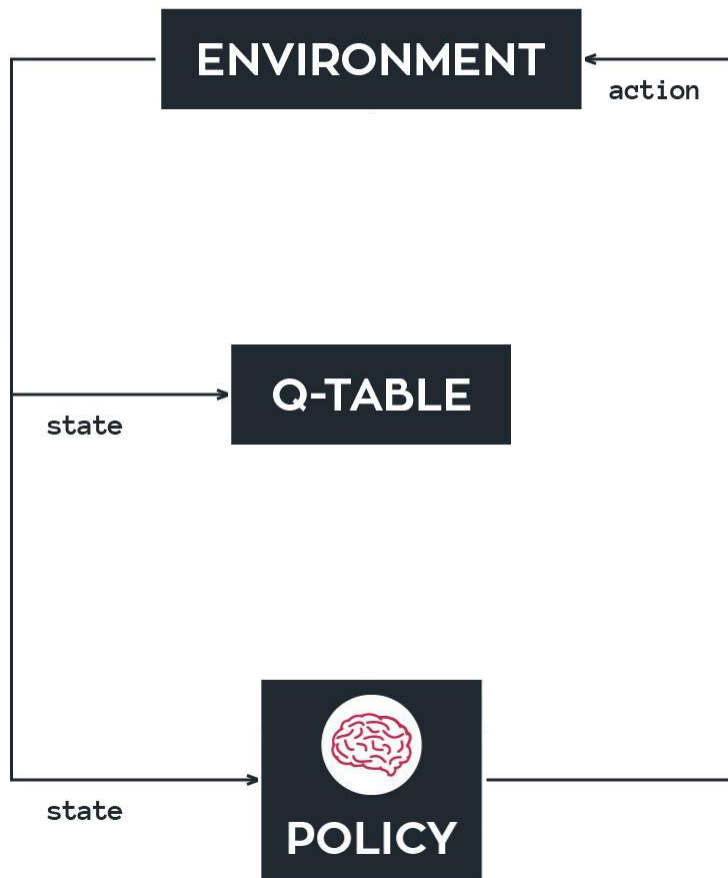
state action result



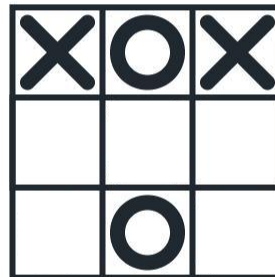
-

-

# Deep Q-Learning

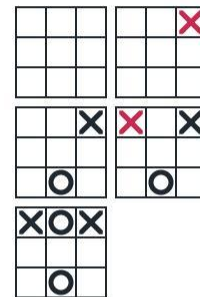


OPPONENT [o]

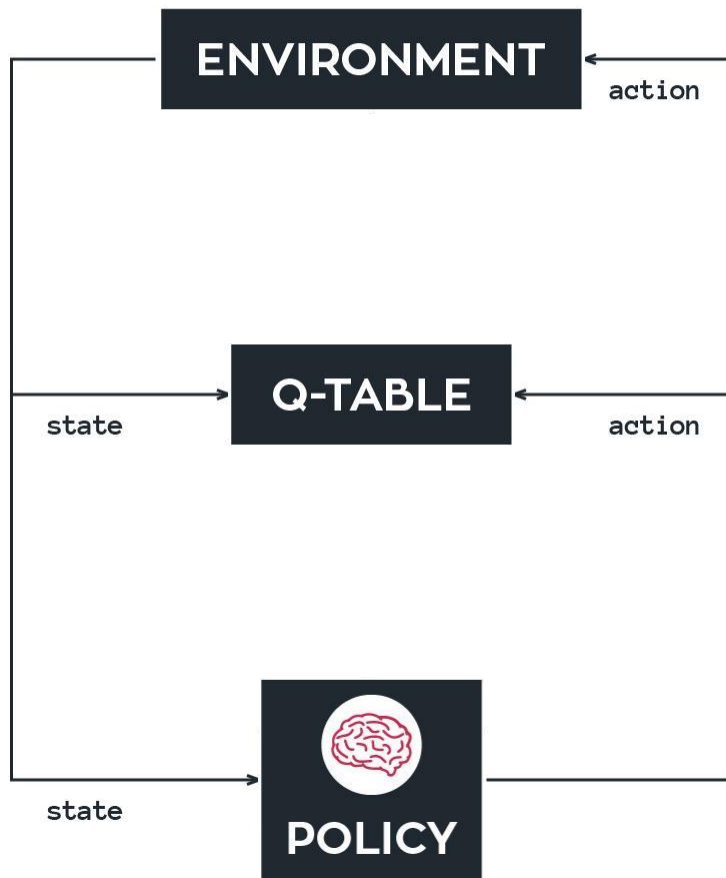


Q-LEARNING  
POLICY [x]

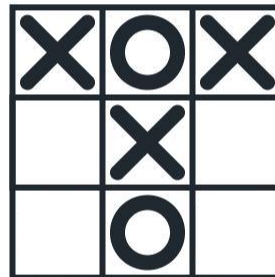
state action result



# Deep Q-Learning

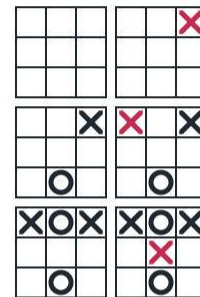


OPPONENT [o]



Q-LEARNING  
POLICY [x]

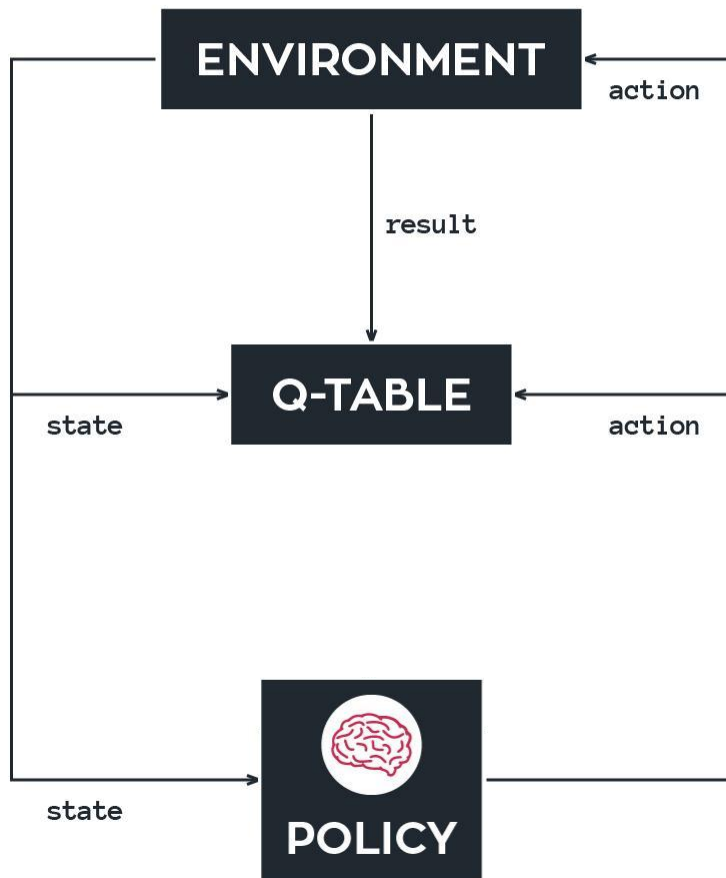
state action result



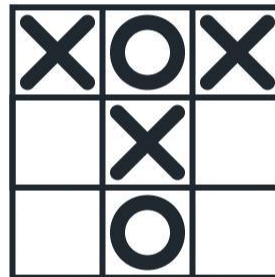
-

-

# Deep Q-Learning

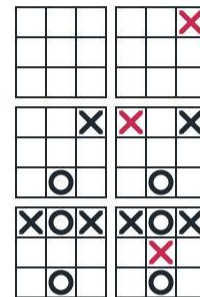


OPPONENT [o]

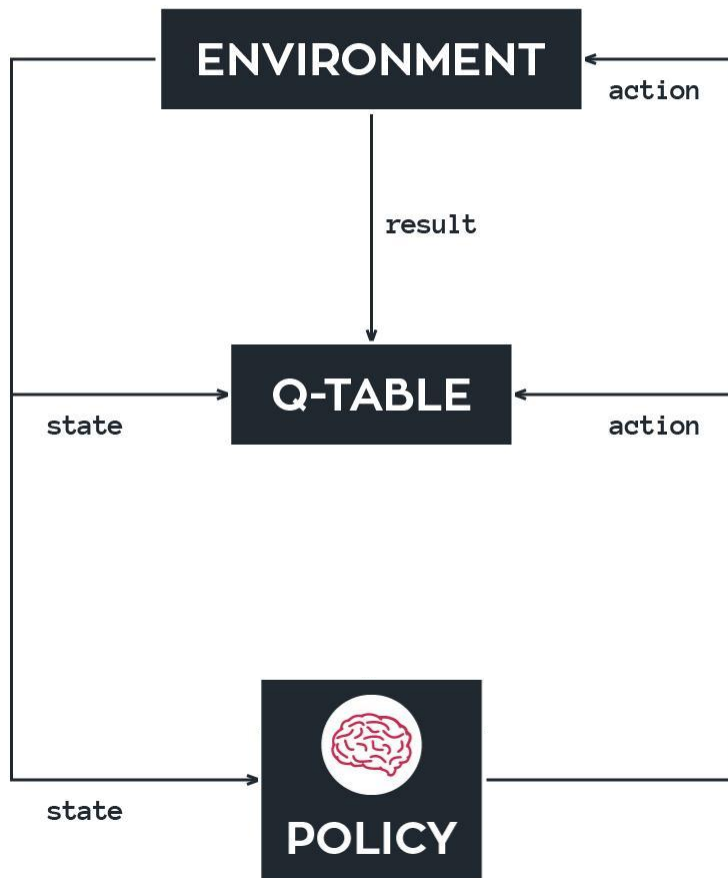


Q-LEARNING  
POLICY [x]

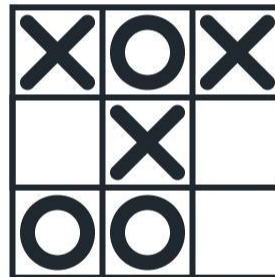
state action result



# Deep Q-Learning

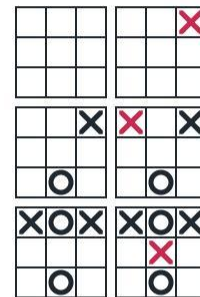


OPPONENT [o]



Q-LEARNING  
POLICY [x]

state action result

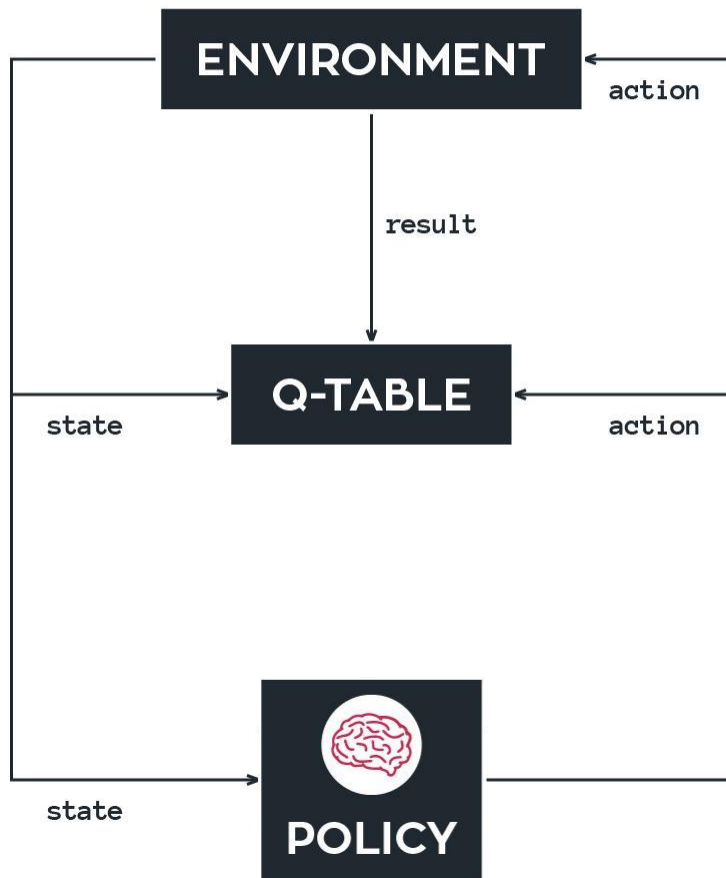


-

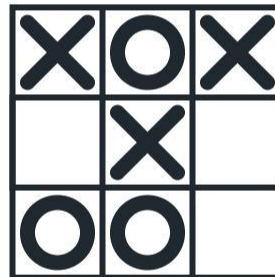
-

-








# Deep Q-Learning



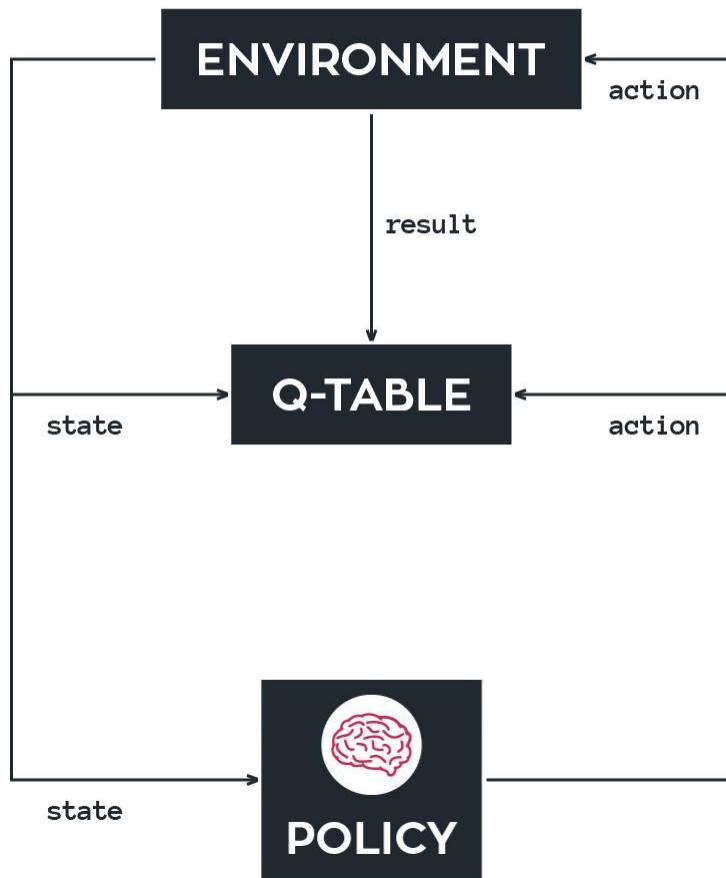
## OPPONENT [o]



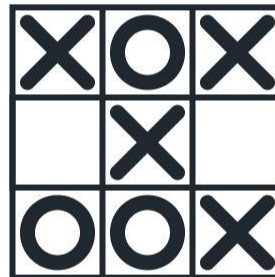
## Q-LEARNING POLICY [x]

state	action	result
		-
		-
		-
		

# Deep Q-Learning



## OPPONENT [o]

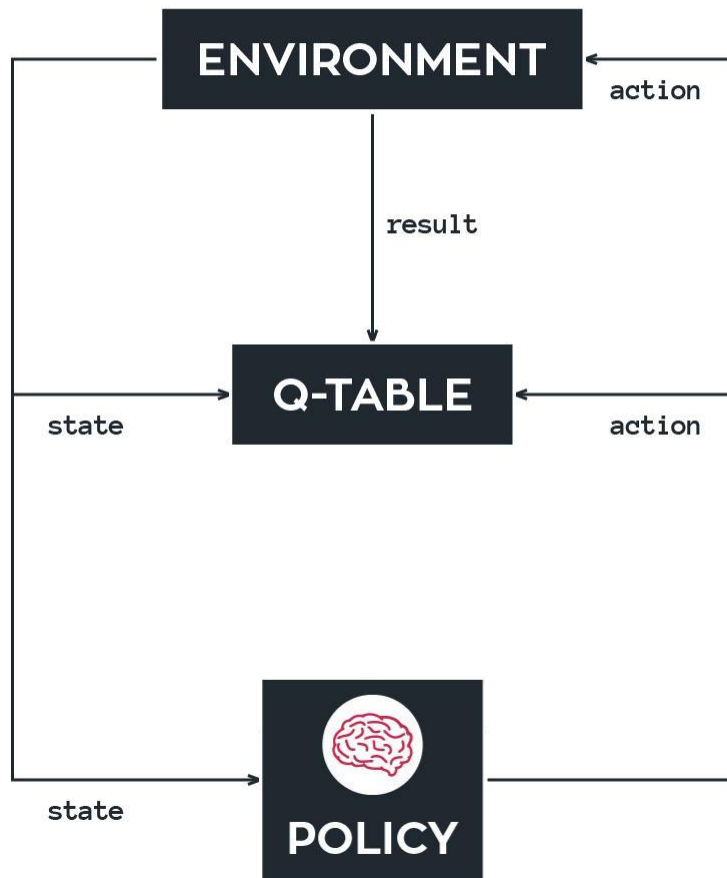


## Q-LEARNING POLICY [x]

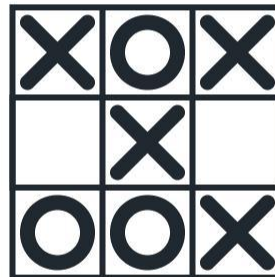
state	action	result
		-
		-
		-
		-



# Deep Q-Learning



OPPONENT [o]

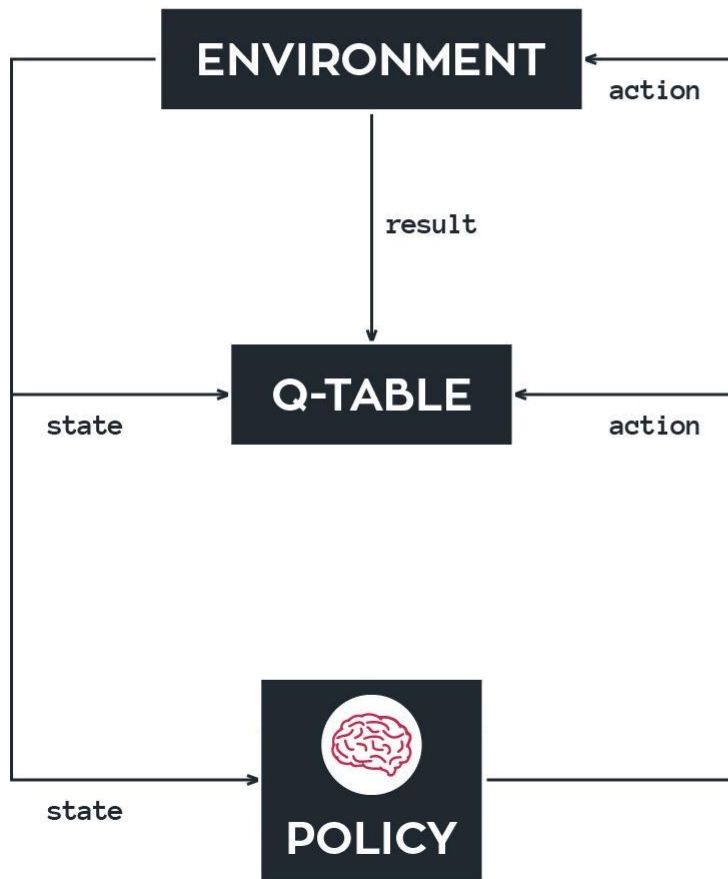


Q-LEARNING  
POLICY [x]

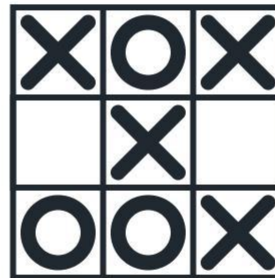
state action result

<div><div></div><div></div><div></div></div>	<div><div></div><div></div><div>X</div></div>	-
<div><div></div><div>X</div><div></div></div>	<div><div>X</div><div></div><div></div></div>	-
<div><div>O</div><div></div><div></div></div>	<div><div></div><div>O</div><div></div></div>	-
<div><div>X</div><div>O</div><div>X</div></div>	<div><div>X</div><div>X</div><div></div></div>	-
<div><div></div><div>O</div><div></div></div>	<div><div></div><div>O</div><div></div></div>	-
<div><div>X</div><div>O</div><div>X</div></div>	<div><div>X</div><div>X</div><div></div></div>	win
<div><div></div><div>X</div><div></div></div>	<div><div></div><div>X</div><div></div></div>	
<div><div>O</div><div>O</div><div></div></div>	<div><div>O</div><div>O</div><div>X</div></div>	

# Deep Q-Learning



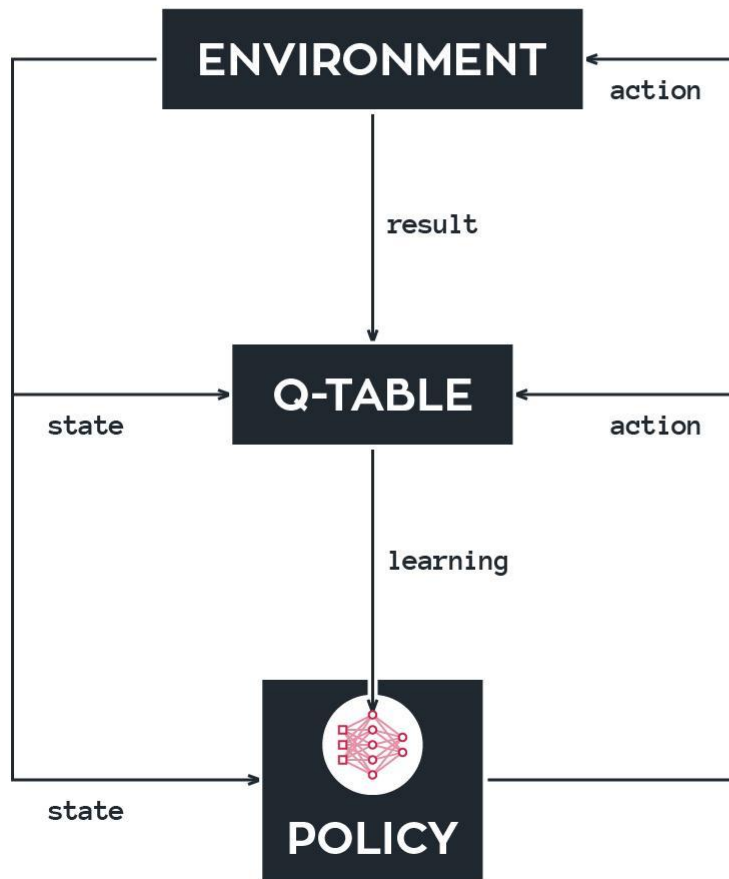
## OPPONENT [o]



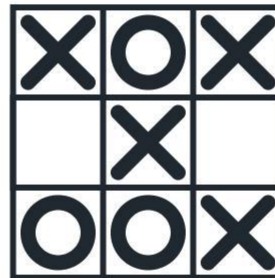
## Q-LEARNING POLICY [x]

state	action	result
		-
		-
		-
		win
		-
		-
		loss

# Deep Q-Learning



OPPONENT [o]

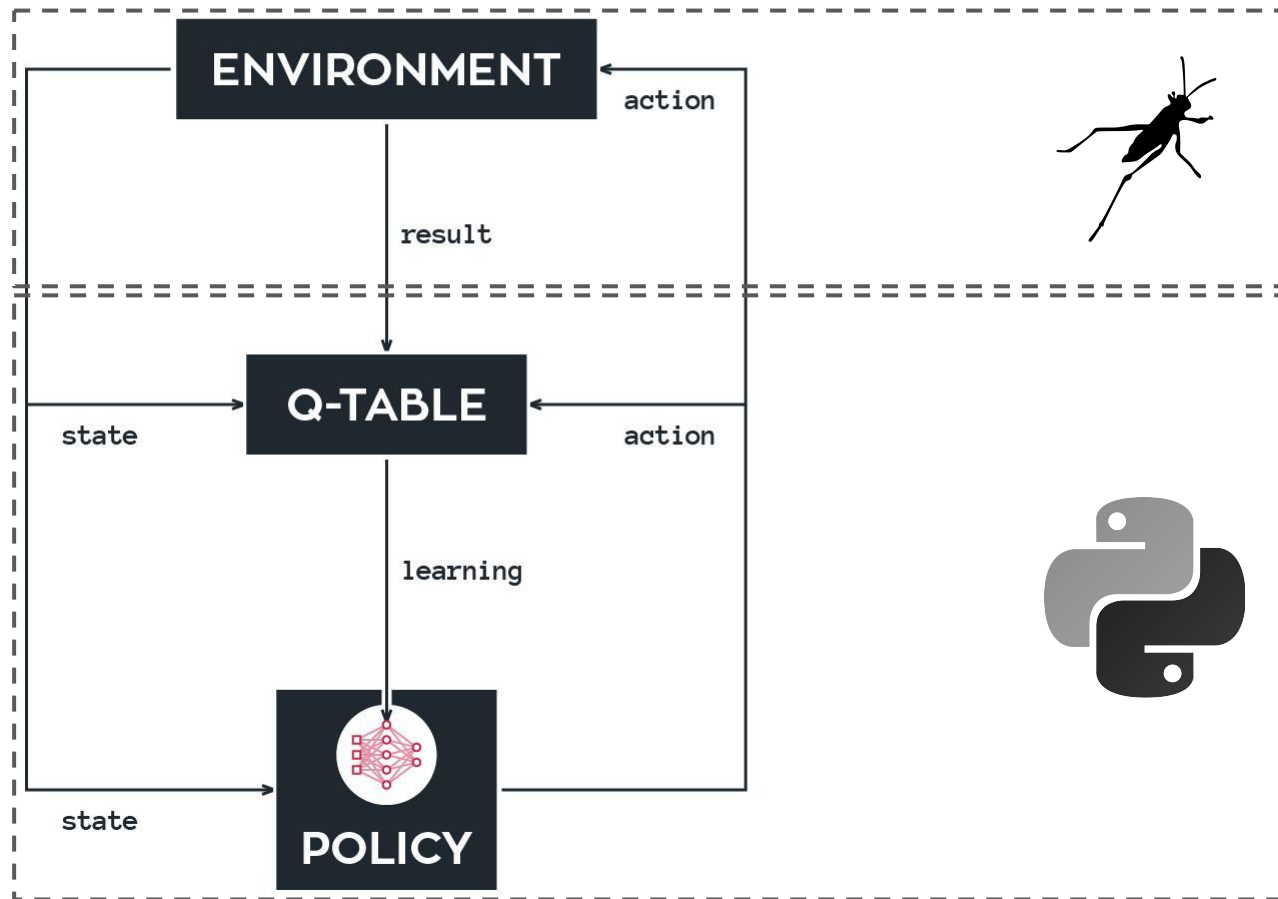


Q-LEARNING  
POLICY [x]

state action result

		-
		-
		-
		win
		-
		-
		loss

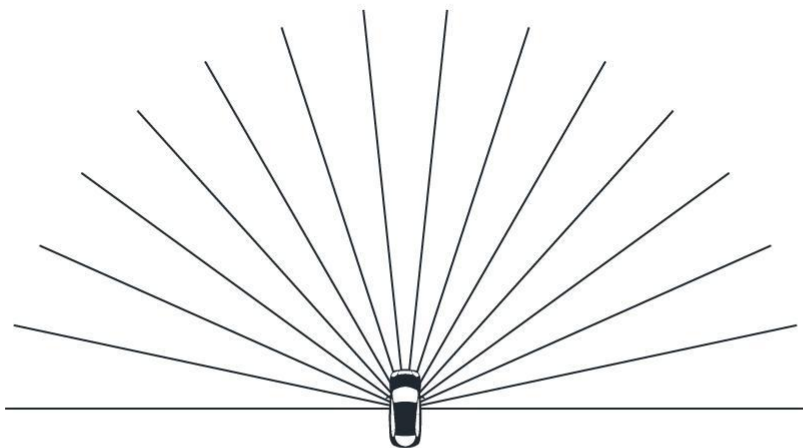
# Deep Q-Learning



# Deep Q-Learning

## AIM:

Train a deep neural network to control the steering of a vehicle for collision avoidance using deep Q-learning.

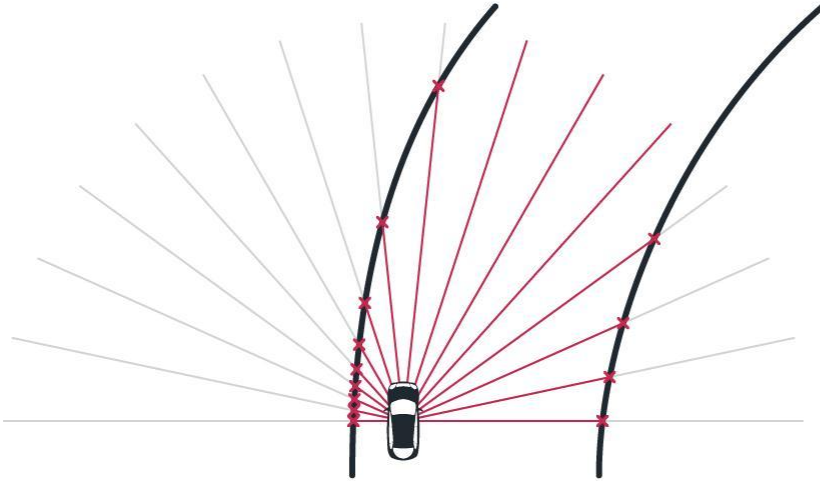


[ 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 , 1.0000 ]

# Deep Q-Learning

## AIM:

Train a deep neural network to control the steering of a vehicle for collision avoidance using deep Q-learning.



[ 0.1248 , 0.1263 , 0.1335 , 0.1481 , 0.1739 , 0.2204 , 0.3103 , 0.4998 , 0.8425 , 1.0000 , 1.0000 , 1.0000 , 0.7750 , 0.6014 , 0.5272 , 0.4977 ]