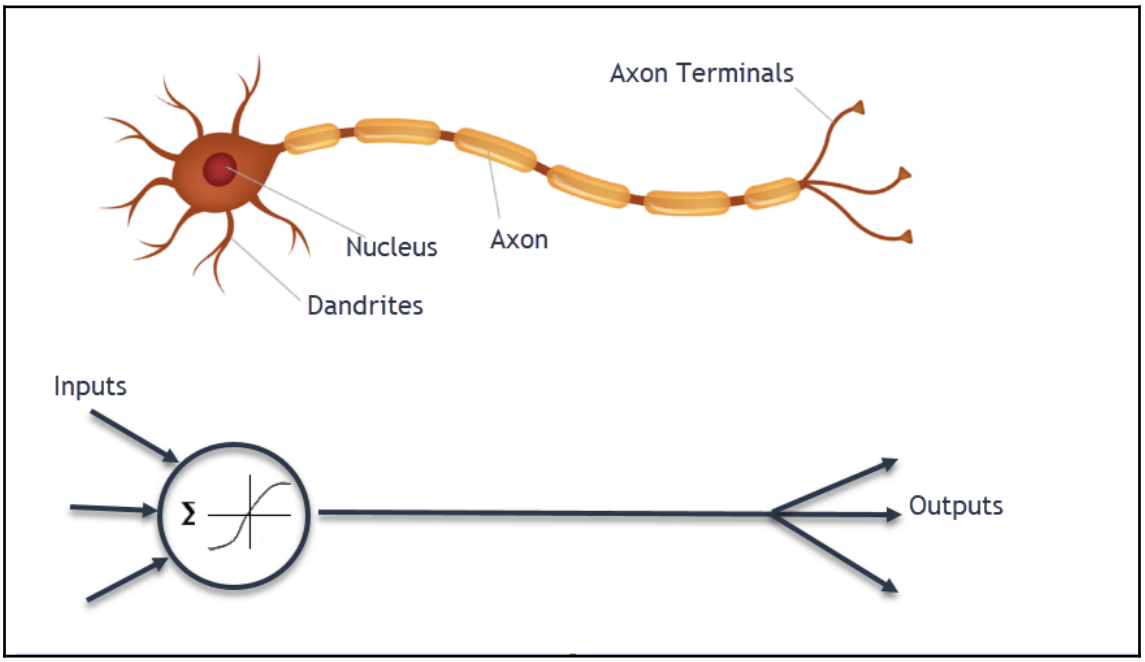
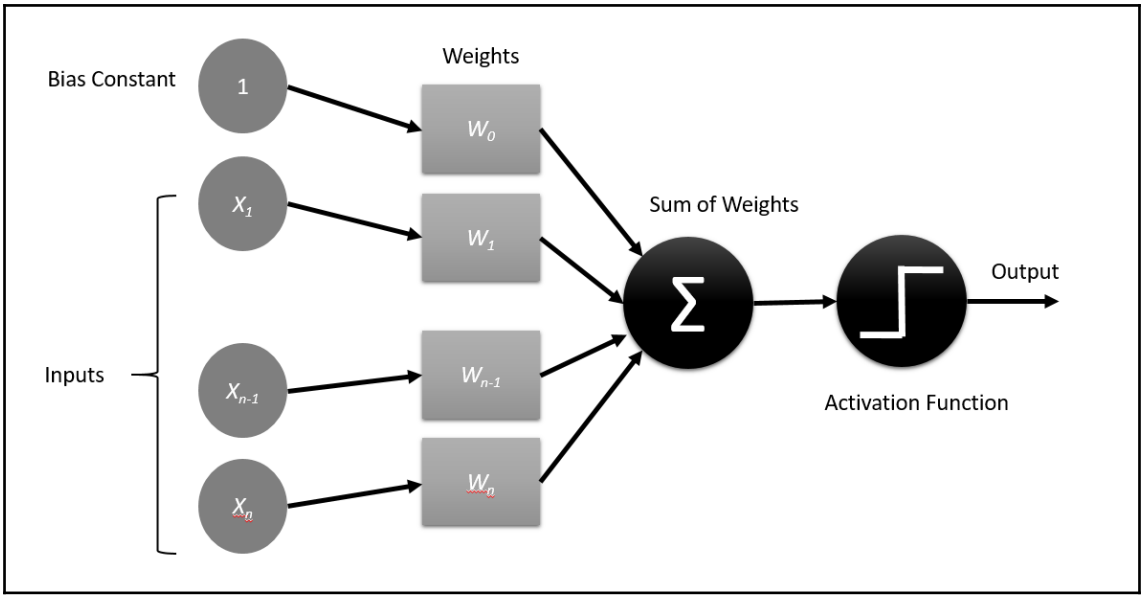
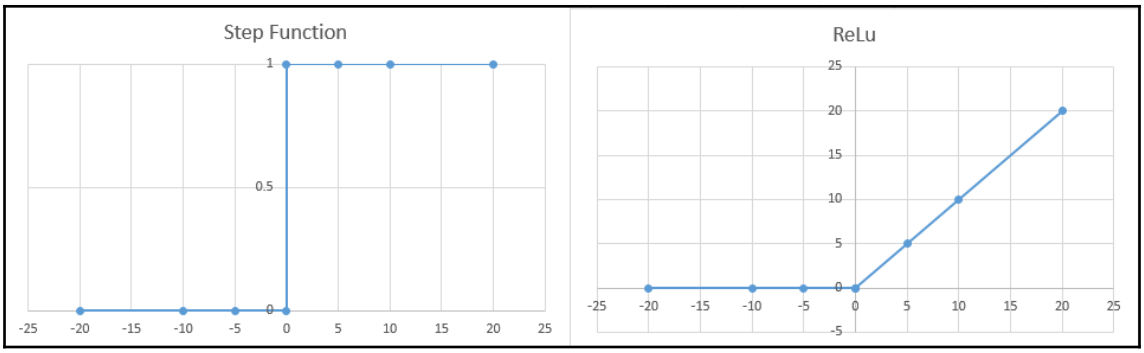
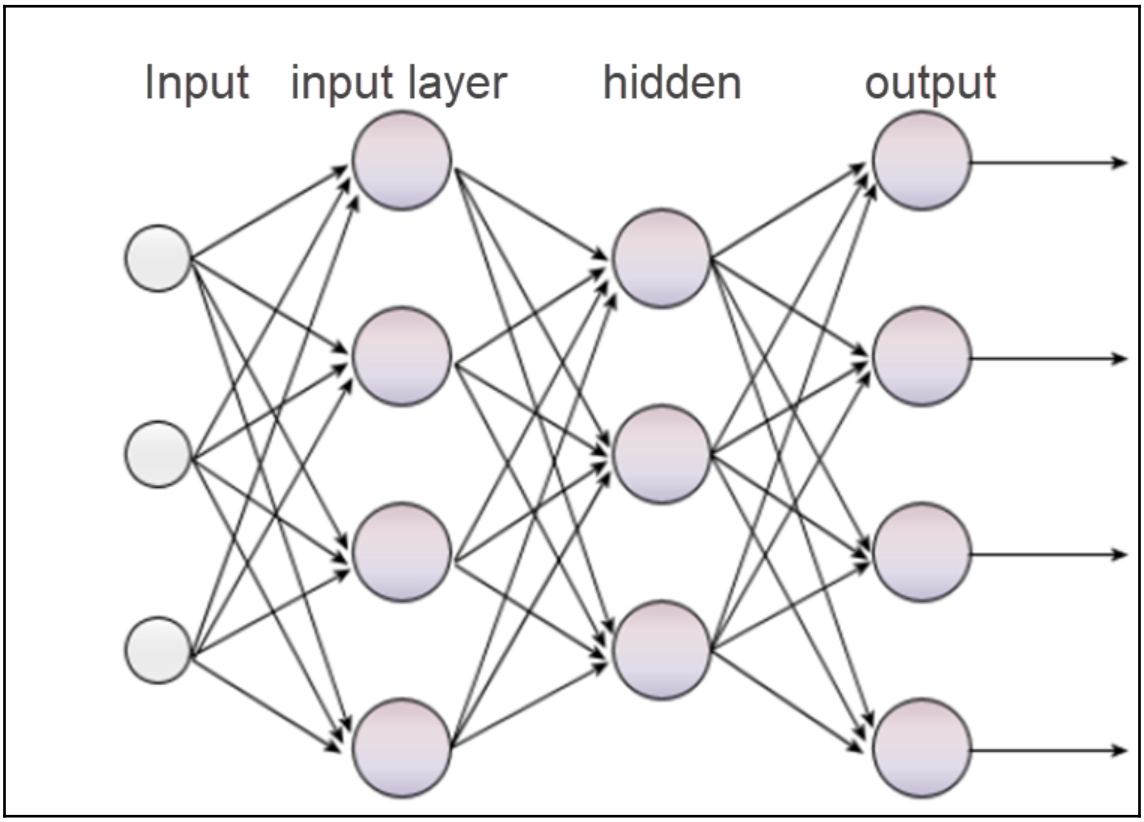
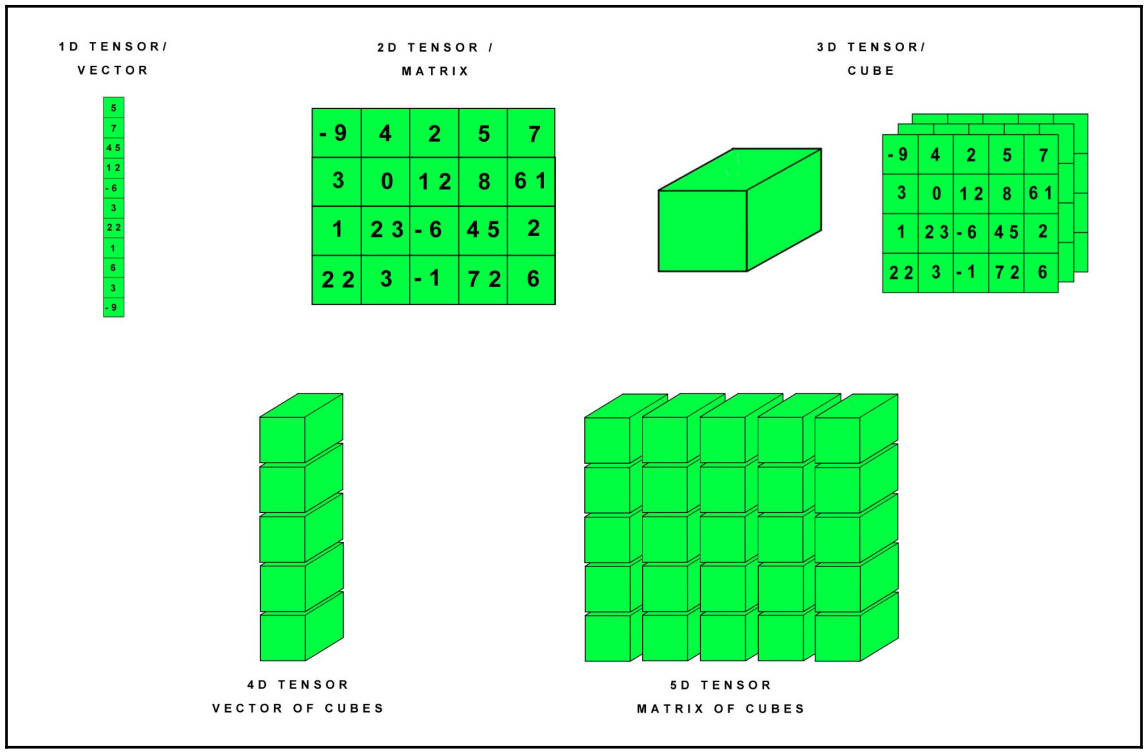
Chapter 1: Deep Learning for Games

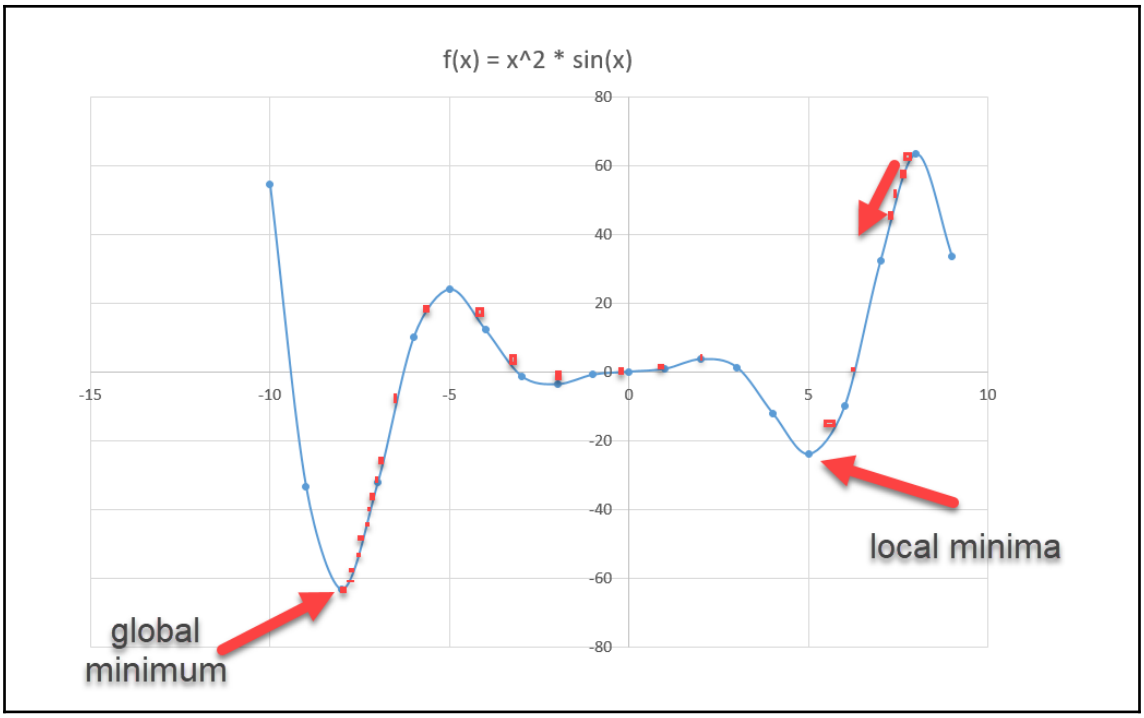


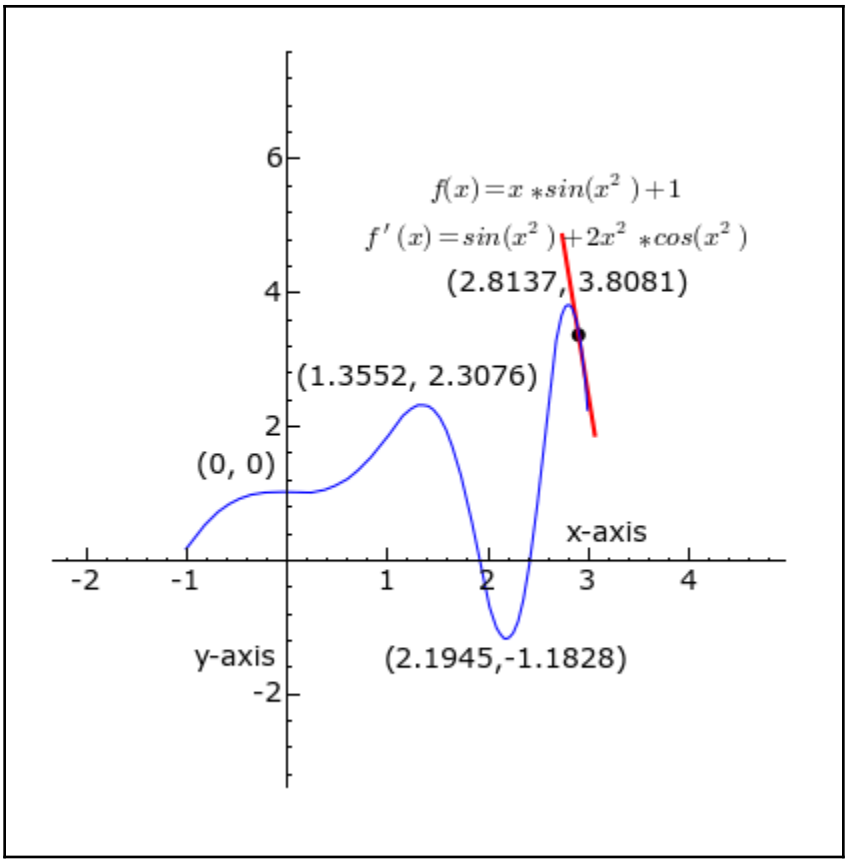


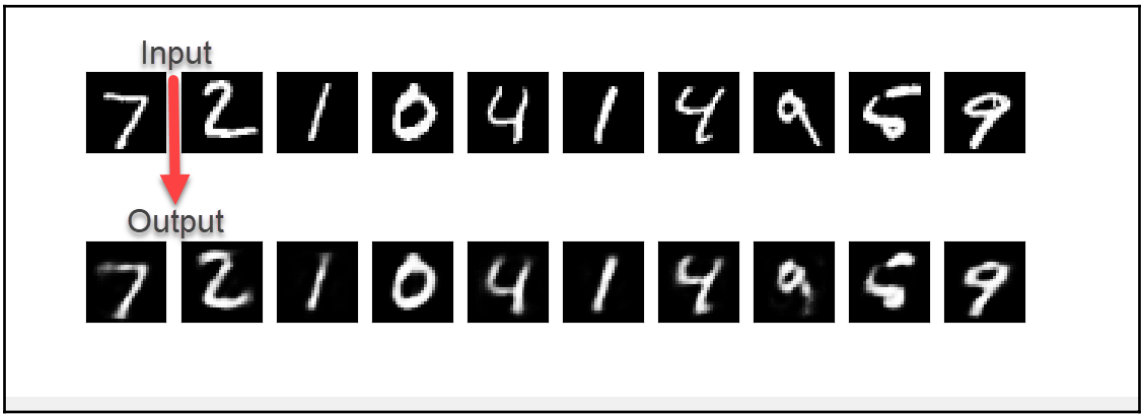

Step Function
1
0.5
0
-25 -20 -15 -10 -5 0 5 10 15 20 25
ReLu
25
20
15
10
5
0
-5
-25 -20 -15 -10 -5 0 5 10 15 20 25


Input
input layer
hidden
output

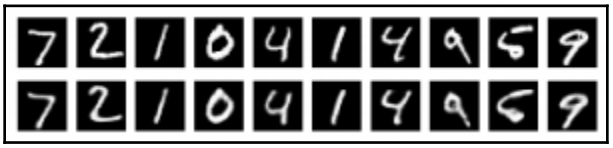

1D TENSOR/
VECTOR
5
7
4 5
1 2
- 6
3
2 2
1
6
3
- 9
2D TENSOR /
MATRIX
- 9 4 2 5 7
3 0 1 2 8 6 1
1 2 3 - 6 4 5 2
2 2 3 - 1 7 2 6
3D TENSOR/
CUBE
4D TENSOR
VECTOR OF CUBES
5D TENSOR
MATRIX OF CUBES

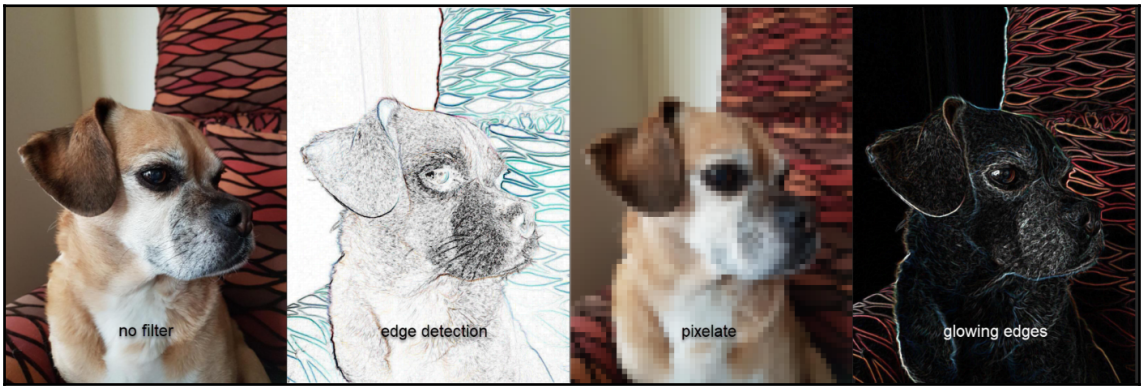

f(x) = x^2 * sin(x)
80
60
40
20
0
-20
-40
-60
-80
-15
-10
-5
0
5
10
global minimum
local minima

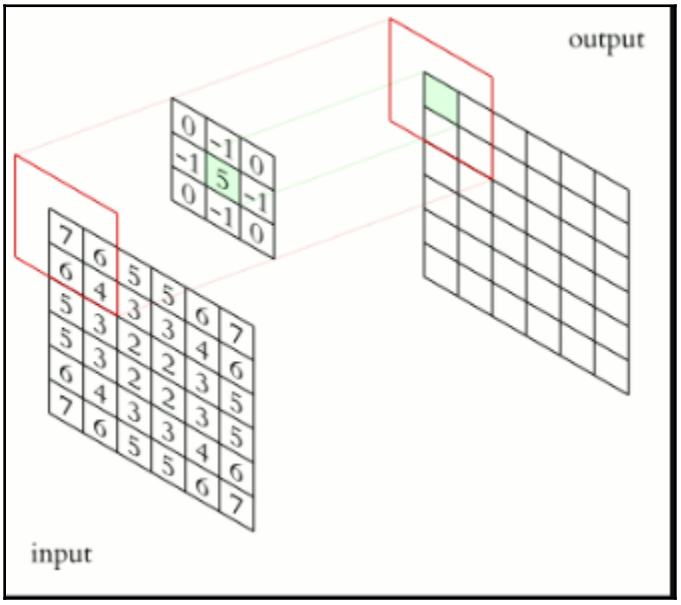

$f(x) = x * sin(x^2) + 1$
$f'(x) = sin(x^2) + 2x^2 * cos(x^2)$
(2.8137, 3.8081)
(1.3552, 2.3076)
(0, 0)
x-axis
y-axis
(2.1945,-1.1828)
6
4
2
-2
-2
-1
1
2
3
4

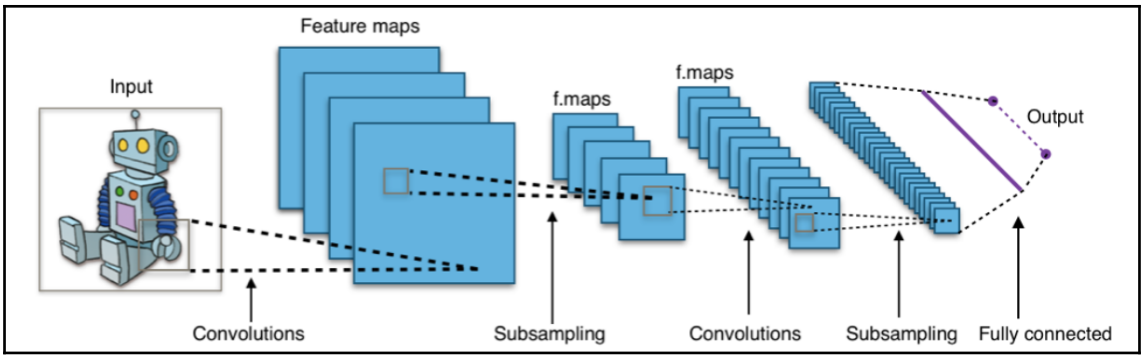

Input
Output

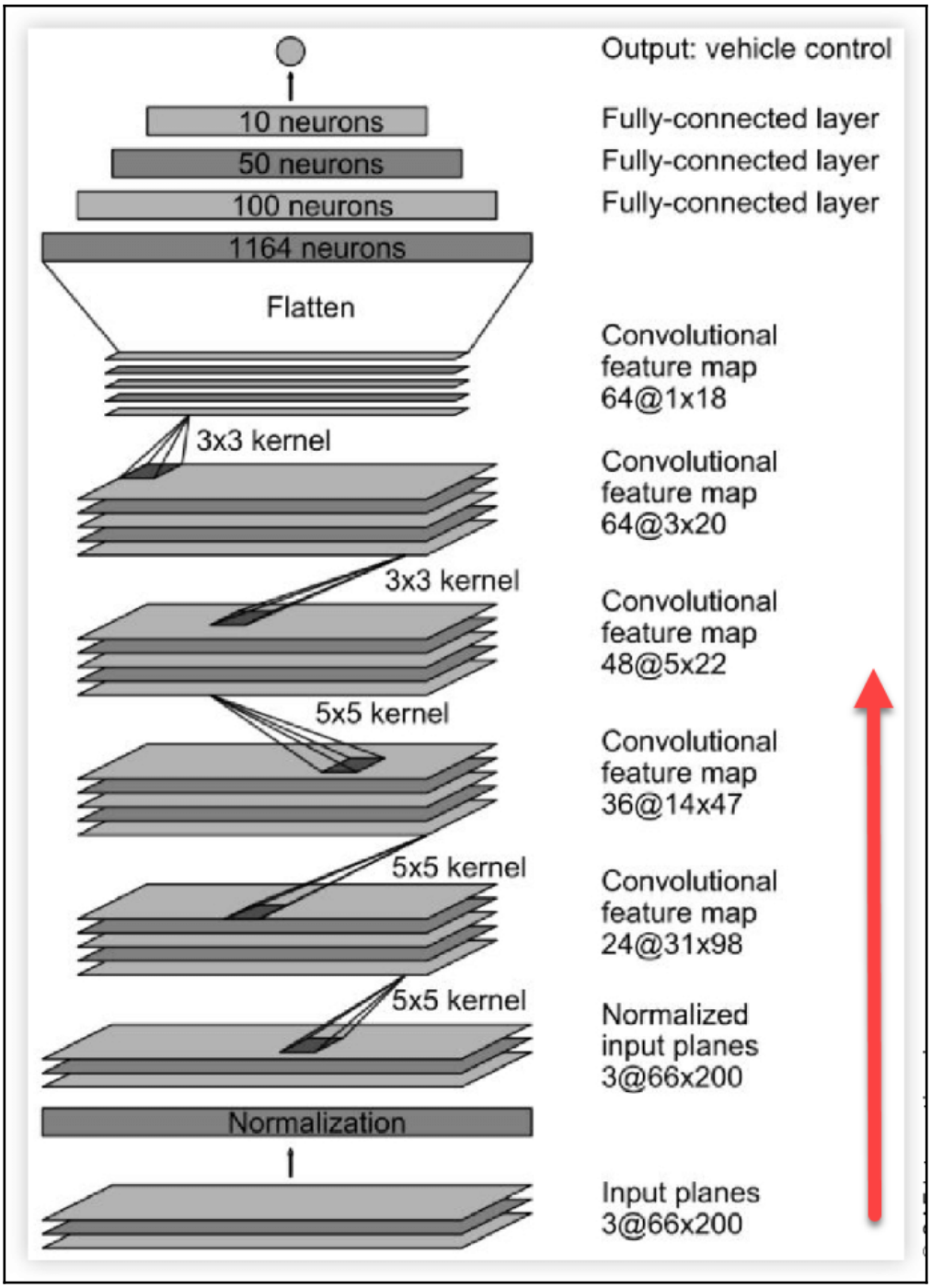
Chapter 2: Convolutional and Recurrent Networks

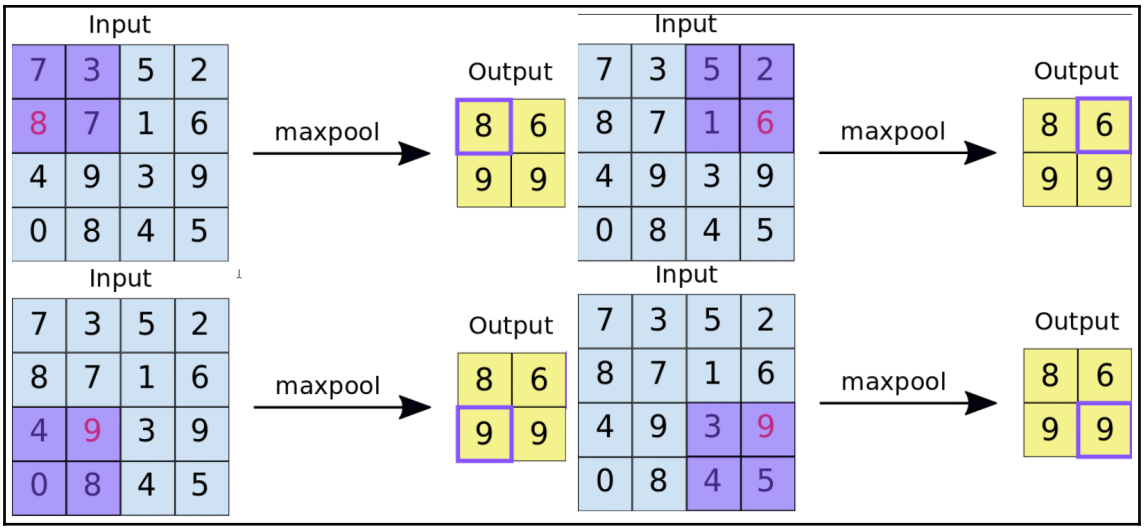


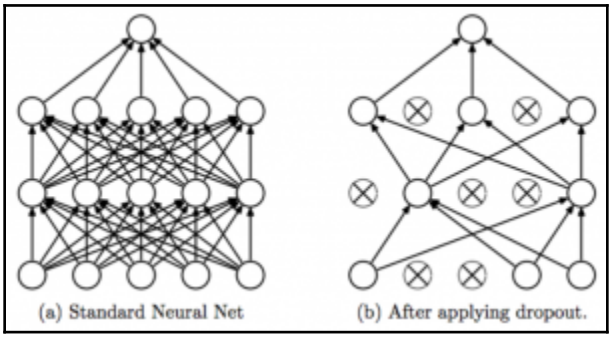


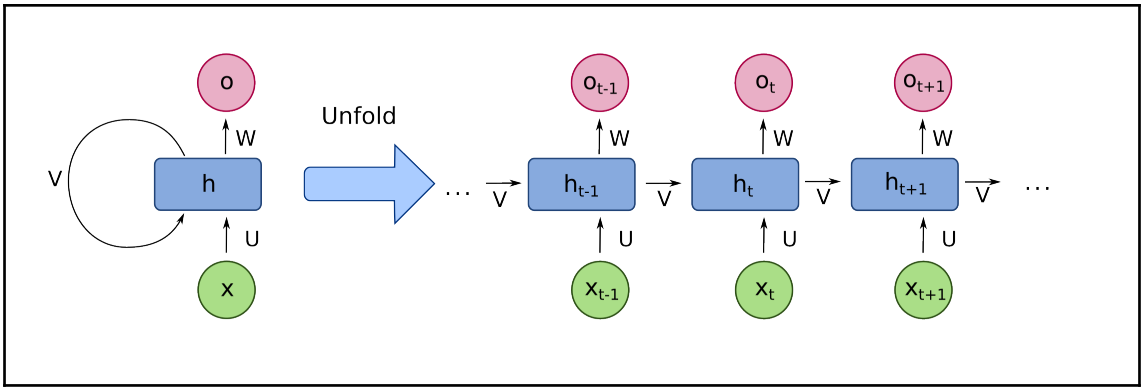


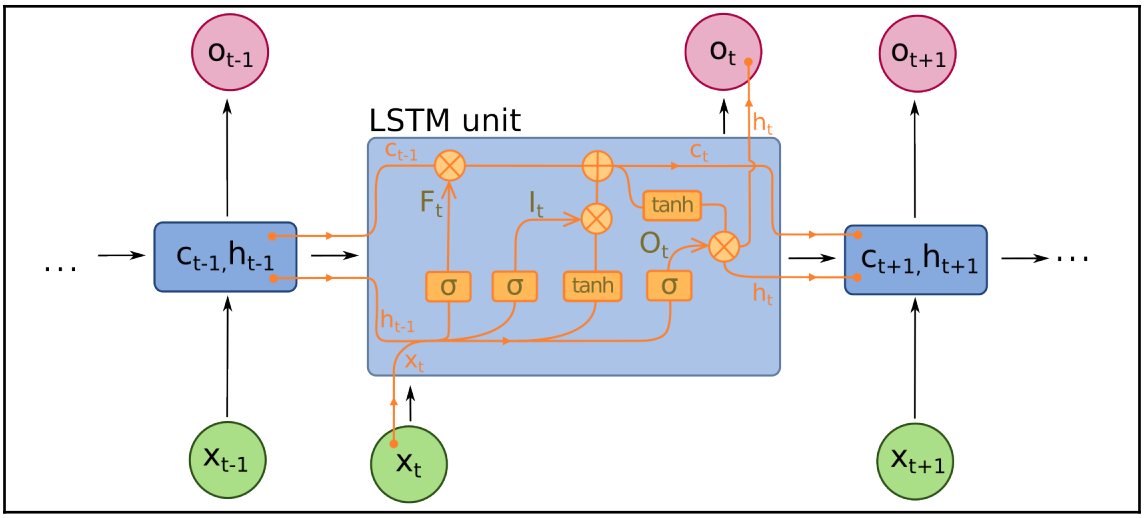

Feature maps
Input
f.maps
f.maps
Output
Convolutions
Subsampling
Convolutions
Subsampling
Fully connected


Output: vehicle control
10 neurons
Fully-connected layer
50 neurons
Fully-connected layer
100 neurons
Fully-connected layer
1164 neurons
Flatten
Convolutional feature map 64@1x18
3x3 kernel
Convolutional feature map 64@3x20
3x3 kernel
Convolutional feature map 48@5x22
5x5 kernel
Convolutional feature map 36@14x47
5x5 kernel
Convolutional feature map 24@31x98
5x5 kernel
Normalized input planes 3@66x200
Normalization
Input planes 3@66x200

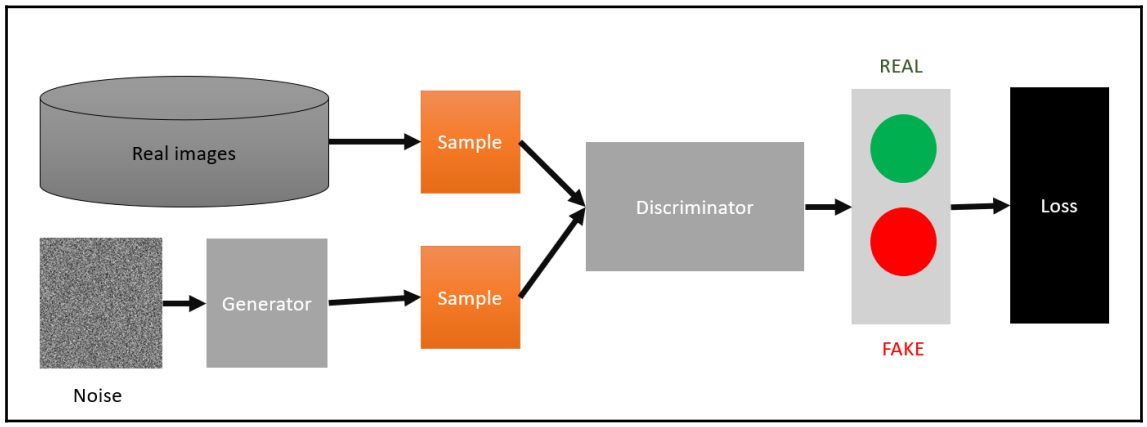

Input
7 3 5 2
8 7 1 6
4 9 3 9
0 8 4 5
maxpool
Output
8 6
9 9
Input
7 3 5 2
8 7 1 6
4 9 3 9
0 8 4 5
maxpool
Output
8 6
9 9
Input
7 3 5 2
8 7 1 6
4 9 3 9
0 8 4 5
maxpool
Output
8 6
9 9
Input
7 3 5 2
8 7 1 6
4 9 3 9
0 8 4 5
maxpool
Output
8 6
9 9

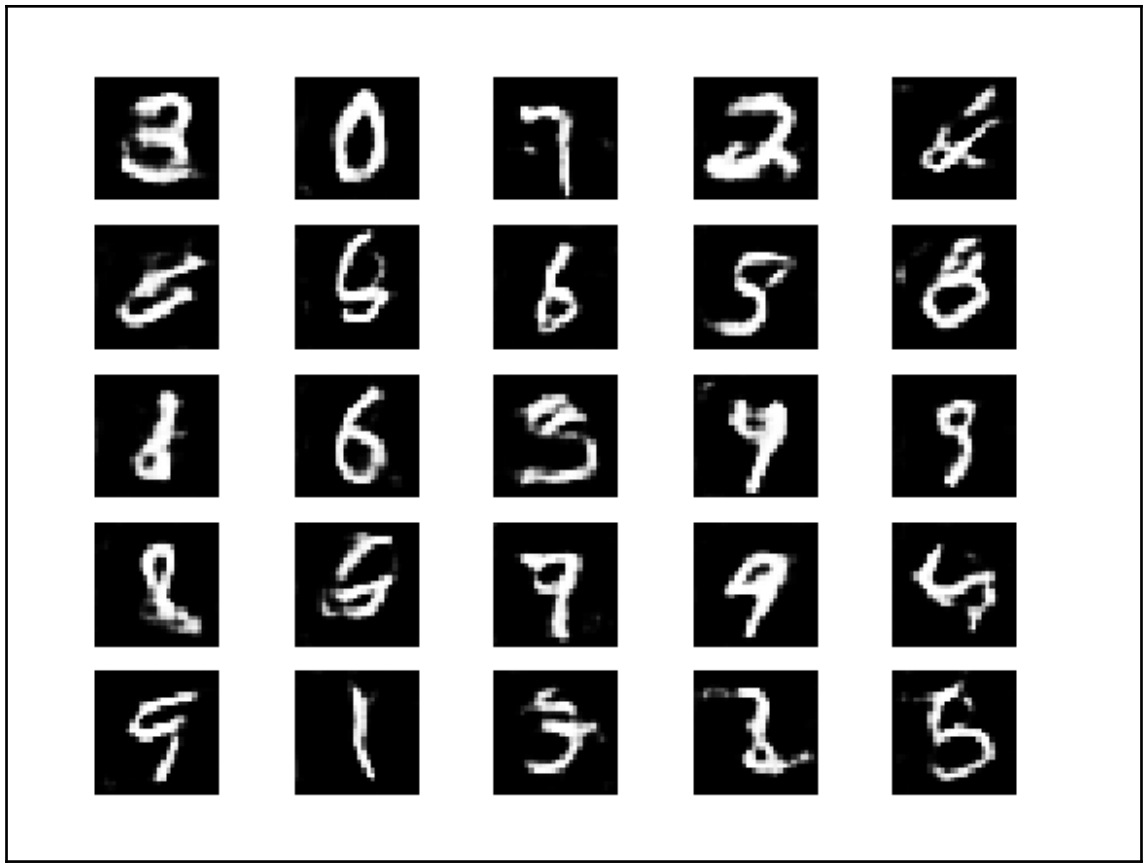

(a) Standard Neural Net
(b) After applying dropout.

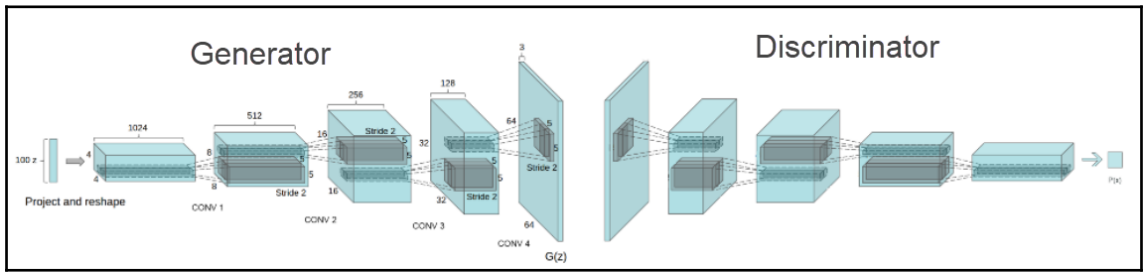

o
W
V
h
U
x
Unfold
...
V
o_{t-1}
W
h_{t-1}
U
x_{t-1}
V
o_t
W
h_t
U
x_t
V
o_{t+1}
W
h_{t+1}
U
x_{t+1}
V
...

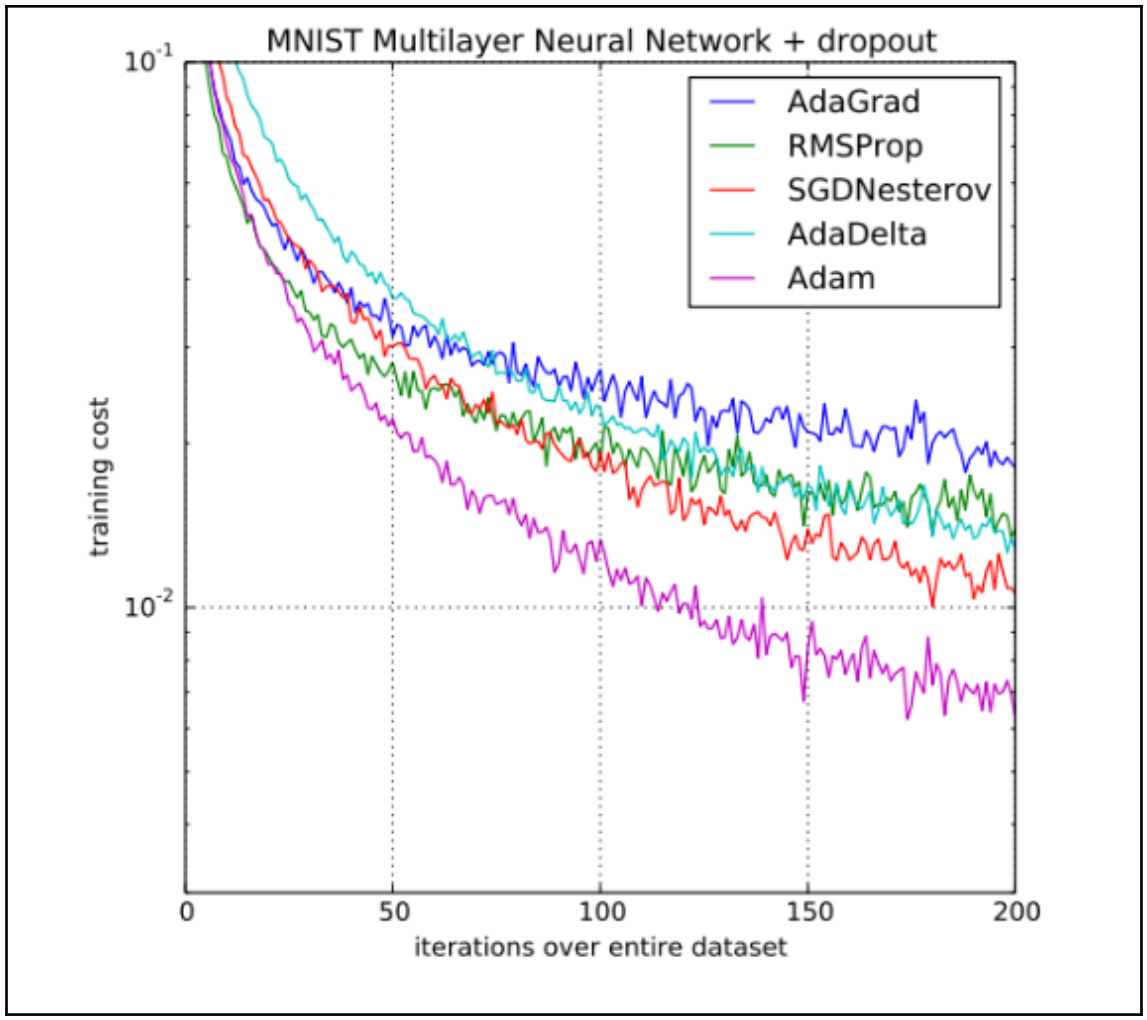

LSTM unit
o_{t-1}
o_t
o_{t+1}
c_{t-1}, h_{t-1}
c_{t+1}, h_{t+1}
x_{t-1}
x_t
x_{t+1}
c_{t-1}
c_t
h_t
F_t
I_t
O_t
tanh
σ
σ
tanh
σ
h_{t-1}
x_t
h_t

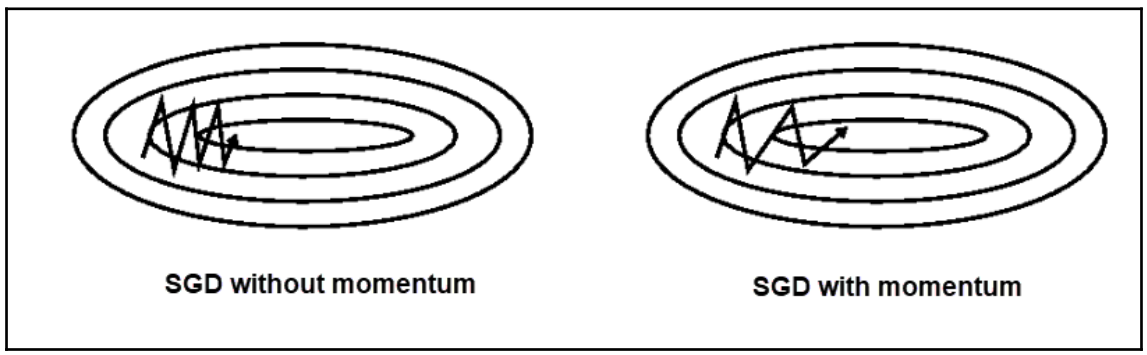
Chapter 3: GAN for Games

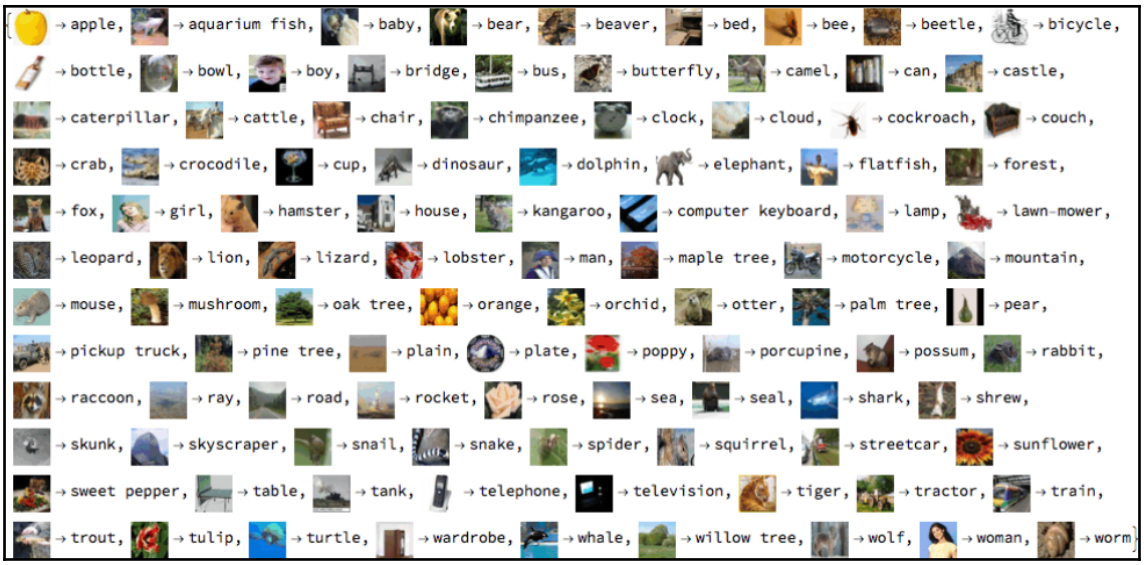


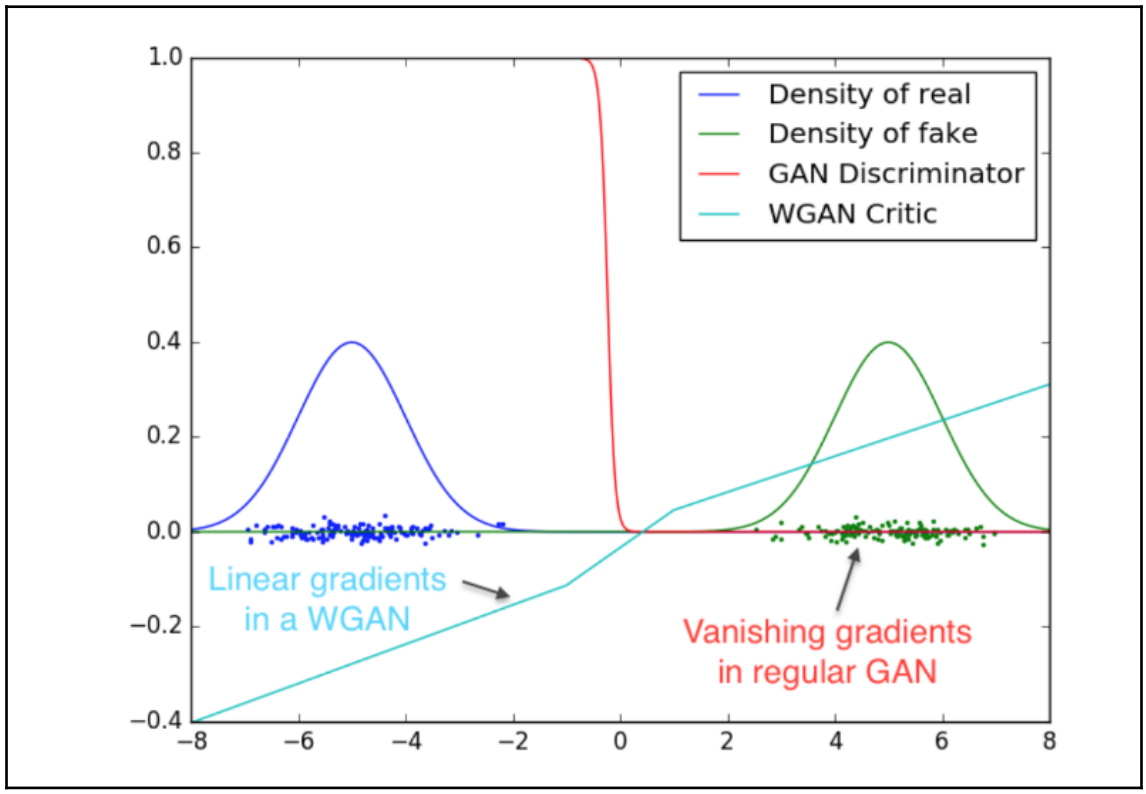


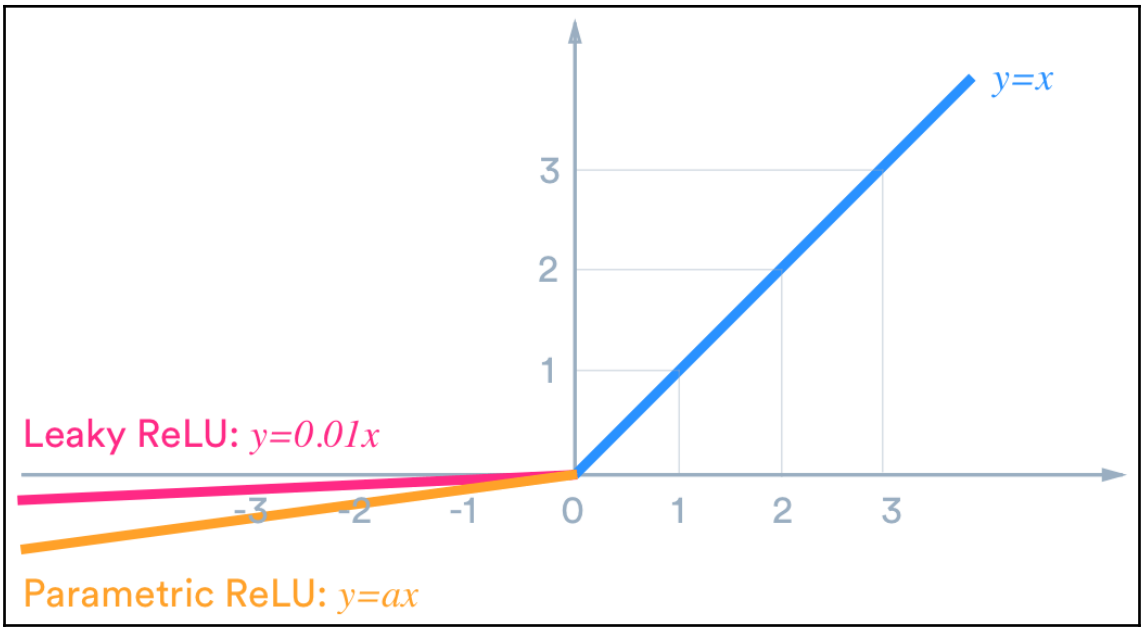

Generator
Discriminator
100 z
Project and reshape
CONV 1
CONV 2
CONV 3
CONV 4
G(z)
Stride 2
1024
512
256
128
3
P(x)

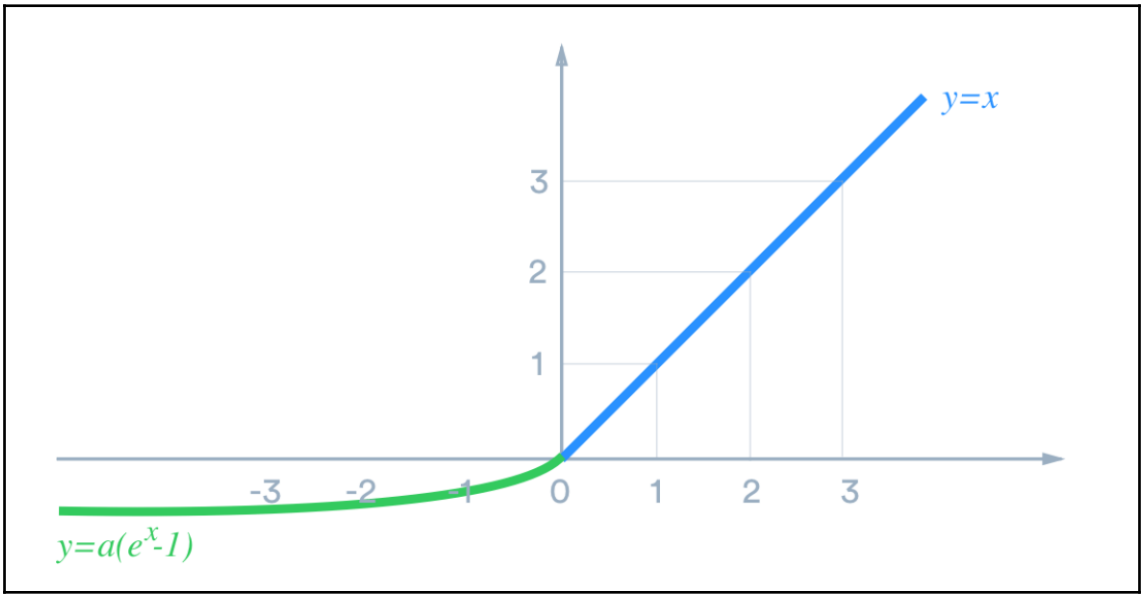

MNIST Multilayer Neural Network + dropout
AdaGrad
RMSProp
SGDNesterov
AdaDelta
Adam
training cost
10^{-1}
10^{-2}
0
50
100
150
200
iterations over entire dataset

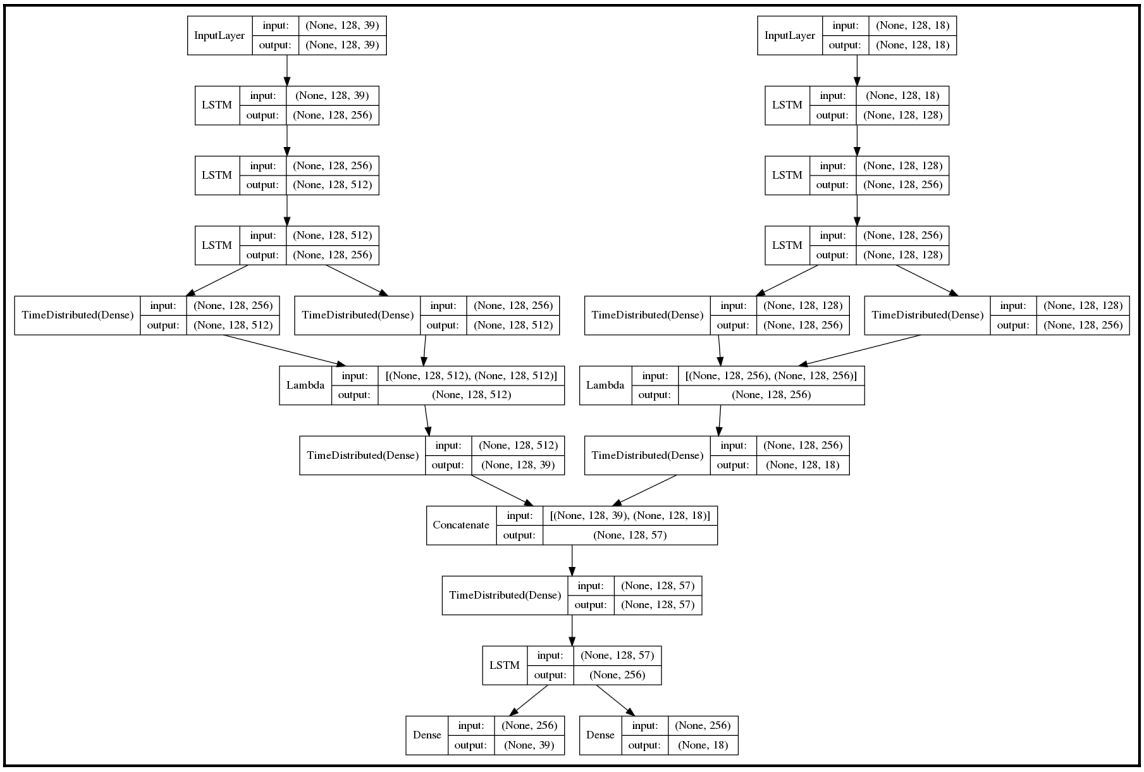

SGD without momentum
SGD with momentum


→ apple, → aquarium fish, → baby, → bear, → beaver, → bed, → bee, → beetle, → bicycle,
→ bottle, → bowl, → boy, → bridge, → bus, → butterfly, → camel, → can, → castle,
→ caterpillar, → cattle, → chair, → chimpanzee, → clock, → cloud, → cockroach, → couch,
→ crab, → crocodile, → cup, → dinosaur, → dolphin, → elephant, → flatfish, → forest,
→ fox, → girl, → hamster, → house, → kangaroo, → computer keyboard, → lamp, → lawn-mower,
→ leopard, → lion, → lizard, → lobster, → man, → maple tree, → motorcycle, → mountain,
→ mouse, → mushroom, → oak tree, → orange, → orchid, → otter, → palm tree, → pear,
→ pickup truck, → pine tree, → plain, → plate, → poppy, → porcupine, → possum, → rabbit,
→ raccoon, → ray, → road, → rocket, → rose, → sea, → seal, → shark, → shrew,
→ skunk, → skyscraper, → snail, → snake, → spider, → squirrel, → streetcar, → sunflower,
→ sweet pepper, → table, → tank, → telephone, → television, → tiger, → tractor, → train,
→ trout, → tulip, → turtle, → wardrobe, → whale, → willow tree, → wolf, → woman, → worm

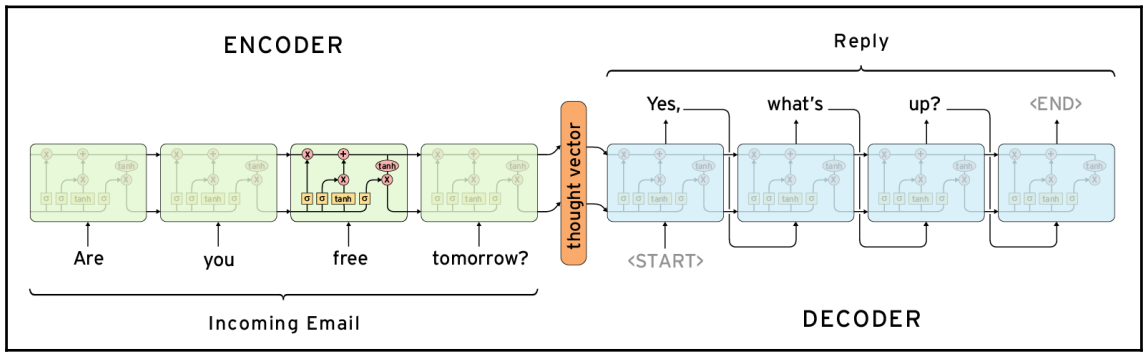

Density of real
Density of fake
GAN Discriminator
WGAN Critic
Linear gradients
in a WGAN
Vanishing gradients
in regular GAN
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−8
−6
−4
−2
0
2
4
6
8

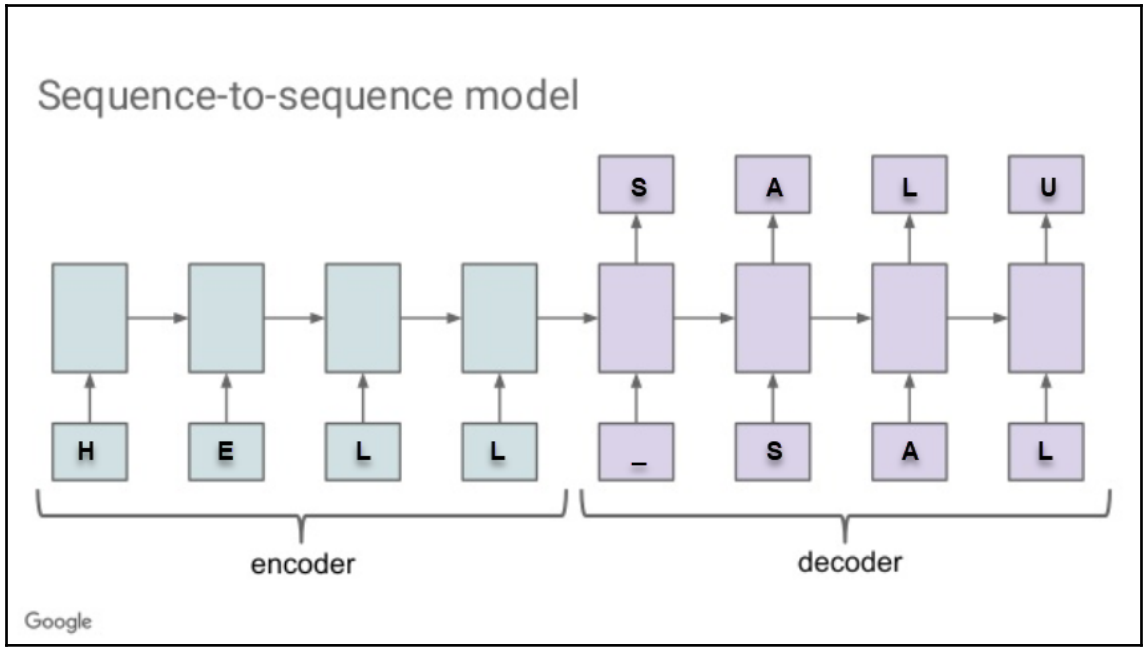

y=x
3
2
1
Leaky ReLU: y=0.01x
-3
-2
-1
0
1
2
3
Parametric ReLU: y=ax

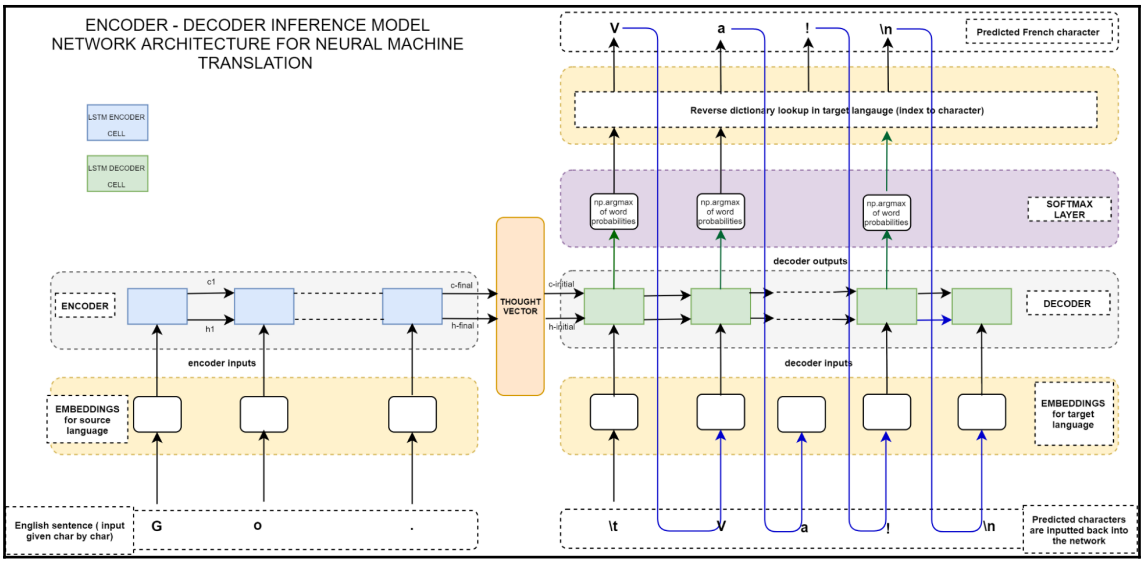

y=x
3
2
1
-3
-2
-1
0
1
2
3
y=a(e^x-1)

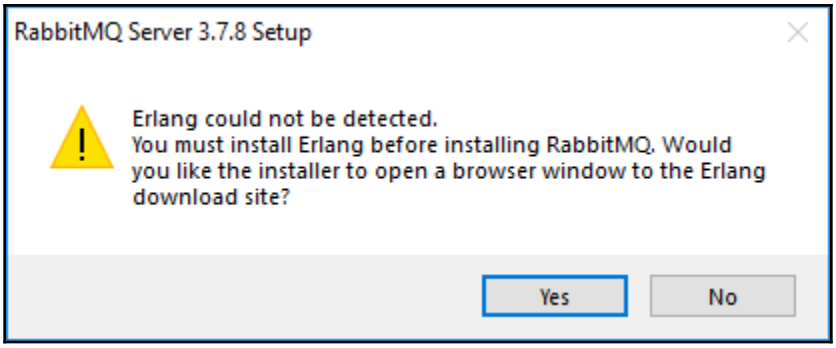

InputLayer
input: (None, 128, 39)
output: (None, 128, 39)
LSTM
input: (None, 128, 39)
output: (None, 128, 256)
LSTM
input: (None, 128, 256)
output: (None, 128, 512)
LSTM
input: (None, 128, 512)
output: (None, 128, 256)
TimeDistributed(Dense)
input: (None, 128, 256)
output: (None, 128, 512)
TimeDistributed(Dense)
input: (None, 128, 256)
output: (None, 128, 512)
Lambda
input: [(None, 128, 512), (None, 128, 512)]
output: (None, 128, 512)
TimeDistributed(Dense)
input: (None, 128, 512)
output: (None, 128, 39)
InputLayer
input: (None, 128, 18)
output: (None, 128, 18)
LSTM
input: (None, 128, 18)
output: (None, 128, 128)
LSTM
input: (None, 128, 128)
output: (None, 128, 256)
LSTM
input: (None, 128, 256)
output: (None, 128, 128)
TimeDistributed(Dense)
input: (None, 128, 128)
output: (None, 128, 256)
TimeDistributed(Dense)
input: (None, 128, 128)
output: (None, 128, 256)
Lambda
input: [(None, 128, 256), (None, 128, 256)]
output: (None, 128, 256)
TimeDistributed(Dense)
input: (None, 128, 256)
output: (None, 128, 18)
Concatenate
input: [(None, 128, 39), (None, 128, 18)]
output: (None, 128, 57)
TimeDistributed(Dense)
input: (None, 128, 57)
output: (None, 128, 57)
LSTM
input: (None, 128, 57)
output: (None, 256)
Dense
input: (None, 256)
output: (None, 39)
Dense
input: (None, 256)
output: (None, 18)

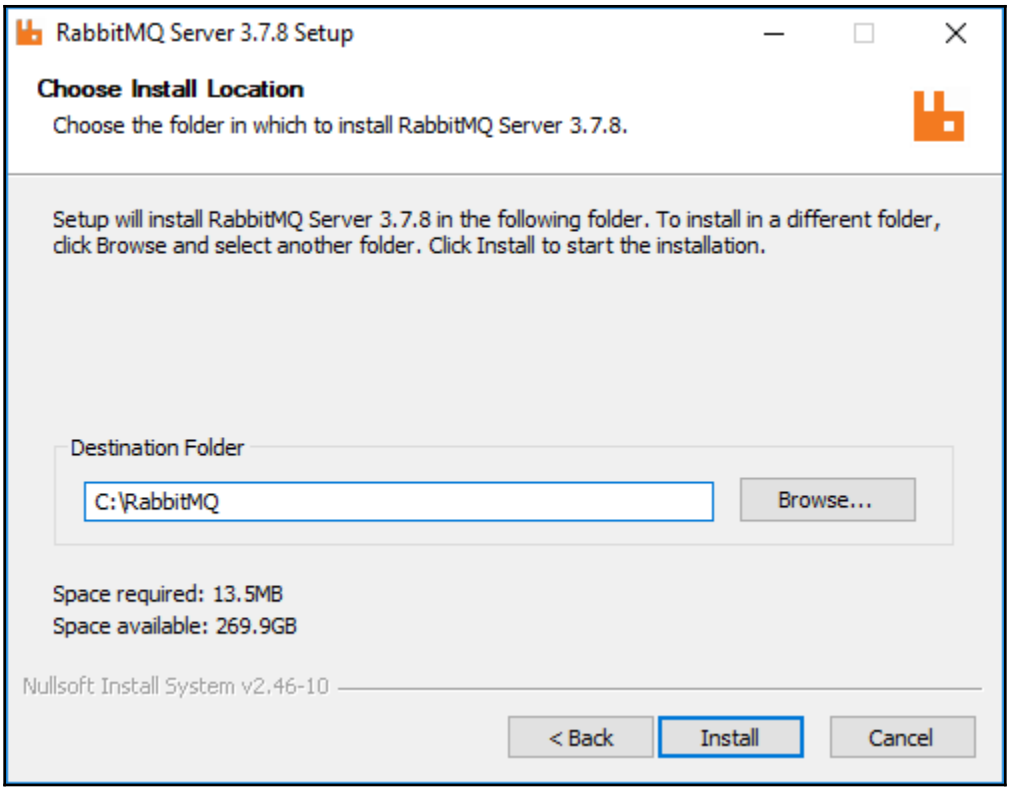
Chapter 4: Building a Deep Learning Gaming Chatbot



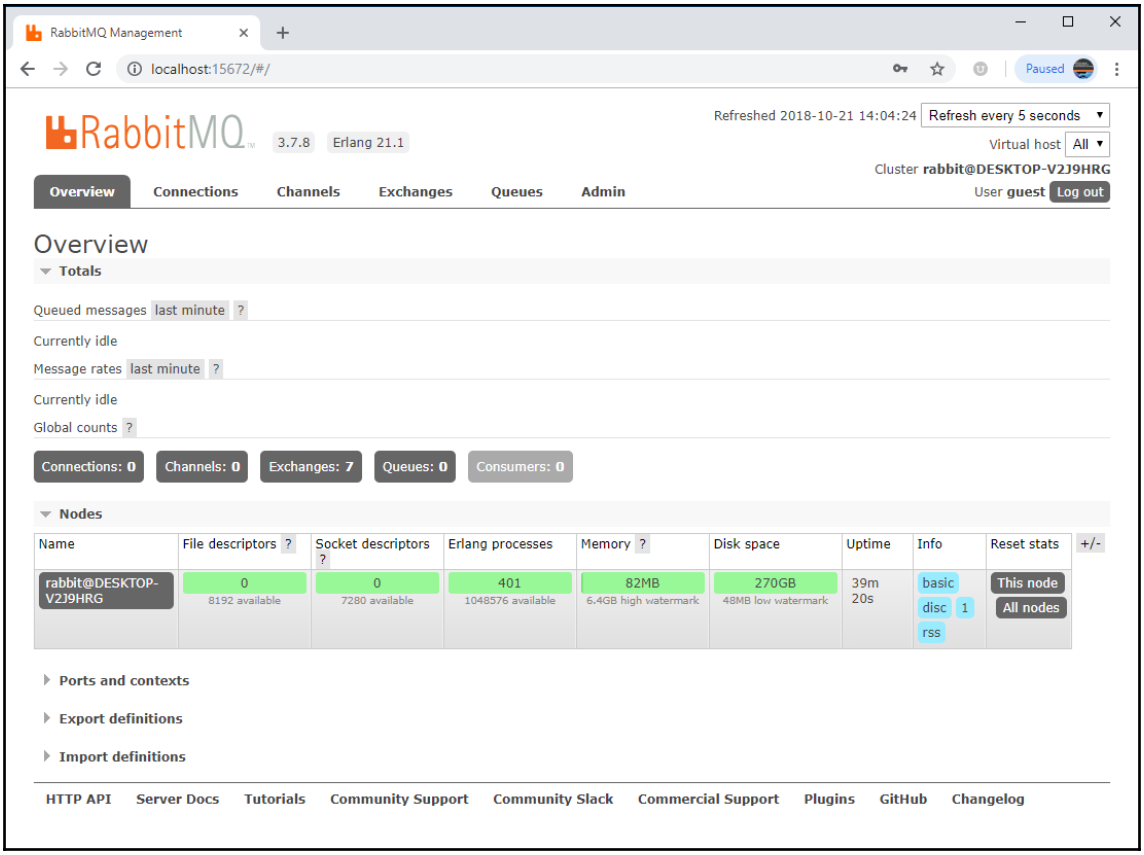


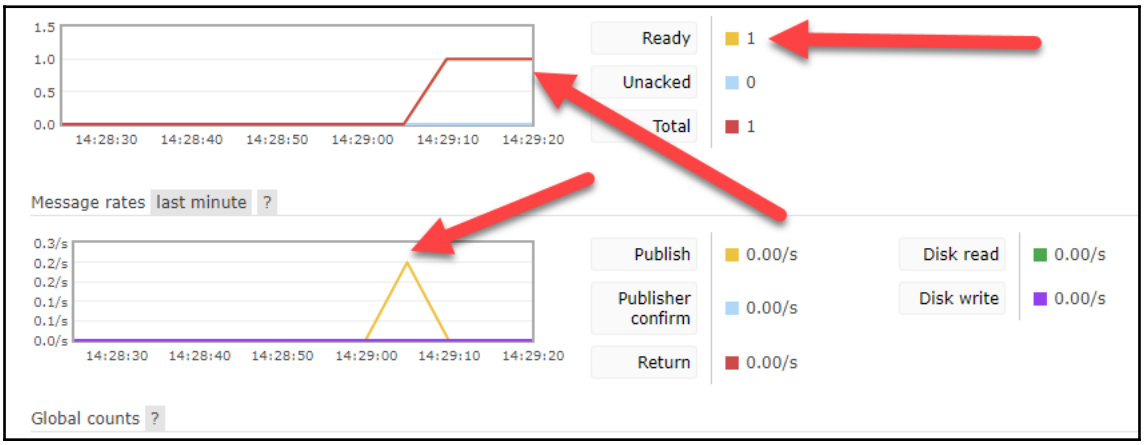

ENCODER - DECODER INFERENCE MODEL
NETWORK ARCHITECTURE FOR NEURAL MACHINE TRANSLATION
LSTM ENCODER CELL
LSTM DECODER CELL
ENCODER
c1
h1
c-final
h-final
THOUGHT VECTOR
c-initial
h-initial
encoder inputs
EMBEDDINGS for source language
English sentence (input given char by char)
G
o
.
V
a
!
\n
Predicted French character
Reverse dictionary lookup in target langauge (index to character)
np.argmax of word probabilities
SOFTMAX LAYER
decoder outputs
DECODER
decoder inputs
EMBEDDINGS for target language
\t
V
a
!
\n
Predicted characters are inputted back into the network

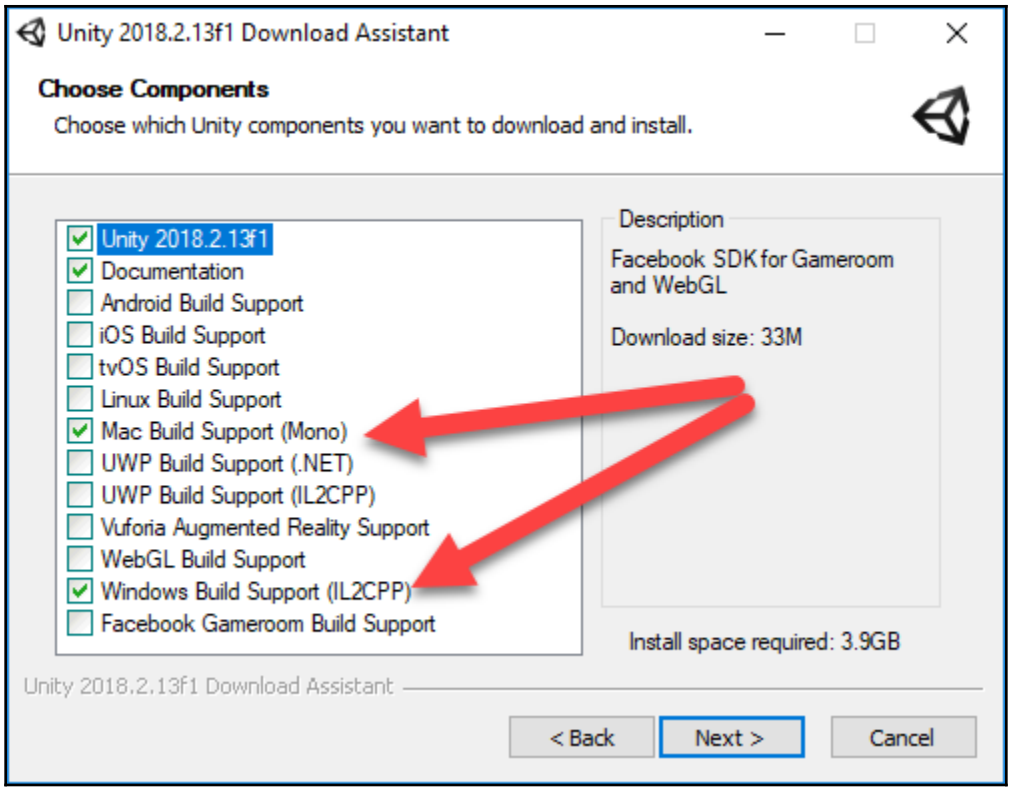

RabbitMQ Server 3.7.8 Setup
Erlang could not be detected.
You must install Erlang before installing RabbitMQ. Would you like the installer to open a browser window to the Erlang download site?
Yes
No

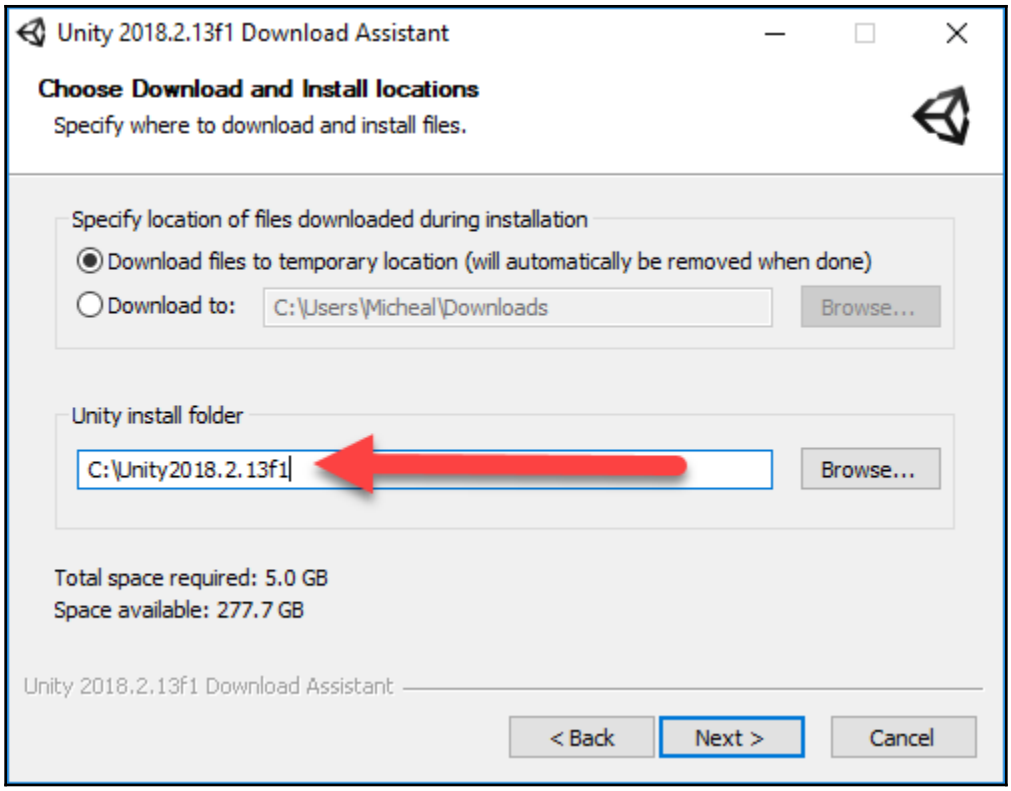


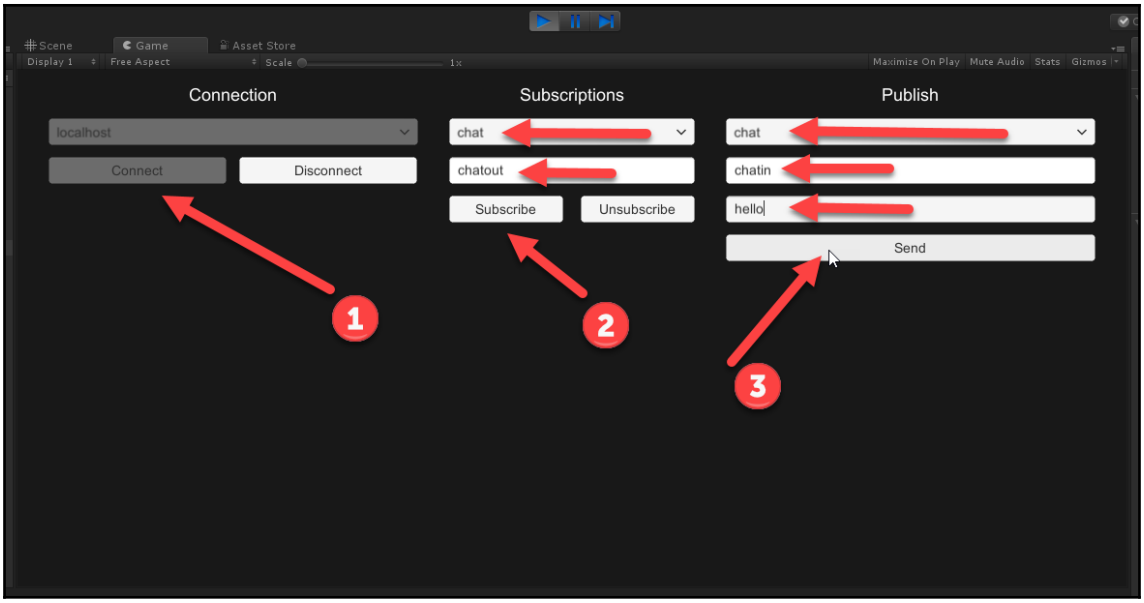

```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.17134.286]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\RabbitMQ\rabbitmq_server-3.7.8\sbin>rabbitmq-plugins enable rabbitmq_management
Enabling plugins on node rabbit@DESKTOP-V2J9HRG:
rabbitmq_management
The following plugins have been configured:
  rabbitmq_management
  rabbitmq_management_agent
  rabbitmq_web_dispatch
Applying plugin configuration to rabbit@DESKTOP-V2J9HRG...
The following plugins have been enabled:
  rabbitmq_management
  rabbitmq_management_agent
  rabbitmq_web_dispatch

started 3 plugins.
```


RabbitMQ Management
localhost:15672/#/
Paused
RabbitMQ
3.7.8
Erlang 21.1
Refreshed 2018-10-21 14:04:24
Refresh every 5 seconds
Virtual host
All
Cluster rabbit@DESKTOP-V2J9HRG
User guest
Log out
Overview
Connections
Channels
Exchanges
Queues
Admin
Overview
Totals
Queued messages last minute ?
Currently idle
Message rates last minute ?
Currently idle
Global counts ?
Connections: 0
Channels: 0
Exchanges: 7
Queues: 0
Consumers: 0
Nodes
Name
File descriptors ?
Socket descriptors ?
Erlang processes
Memory ?
Disk space
Uptime
Info
Reset stats
+/-
rabbit@DESKTOP-V2J9HRG
0
8192 available
0
7280 available
401
1048576 available
82MB
6.4GB high watermark
270GB
48MB low watermark
39m 20s
basic
disc 1
rss
This node
All nodes
Ports and contexts
Export definitions
Import definitions
HTTP API
Server Docs
Tutorials
Community Support
Community Slack
Commercial Support
Plugins
GitHub
Changelog

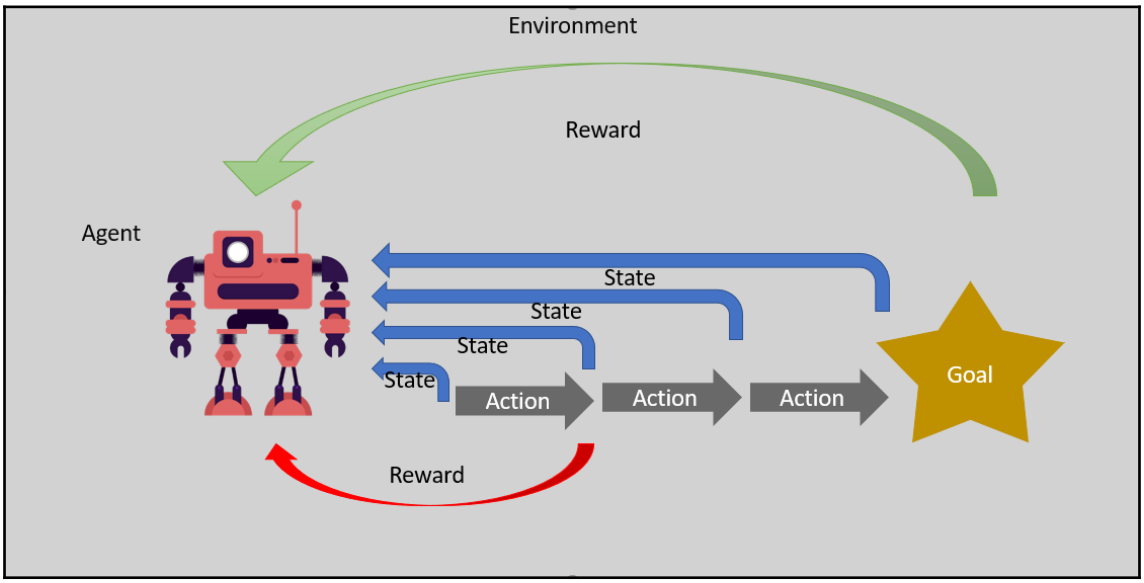

1.5
1.0
0.5
0.0
14:28:30
14:28:40
14:28:50
14:29:00
14:29:10
14:29:20
Ready
1
Unacked
0
Total
1
Message rates last minute ?
0.3/s
0.2/s
0.2/s
0.1/s
0.1/s
0.0/s
14:28:30
14:28:40
14:28:50
14:29:00
14:29:10
14:29:20
Publish
0.00/s
Publisher confirm
0.00/s
Return
0.00/s
Disk read
0.00/s
Disk write
0.00/s
Global counts ?

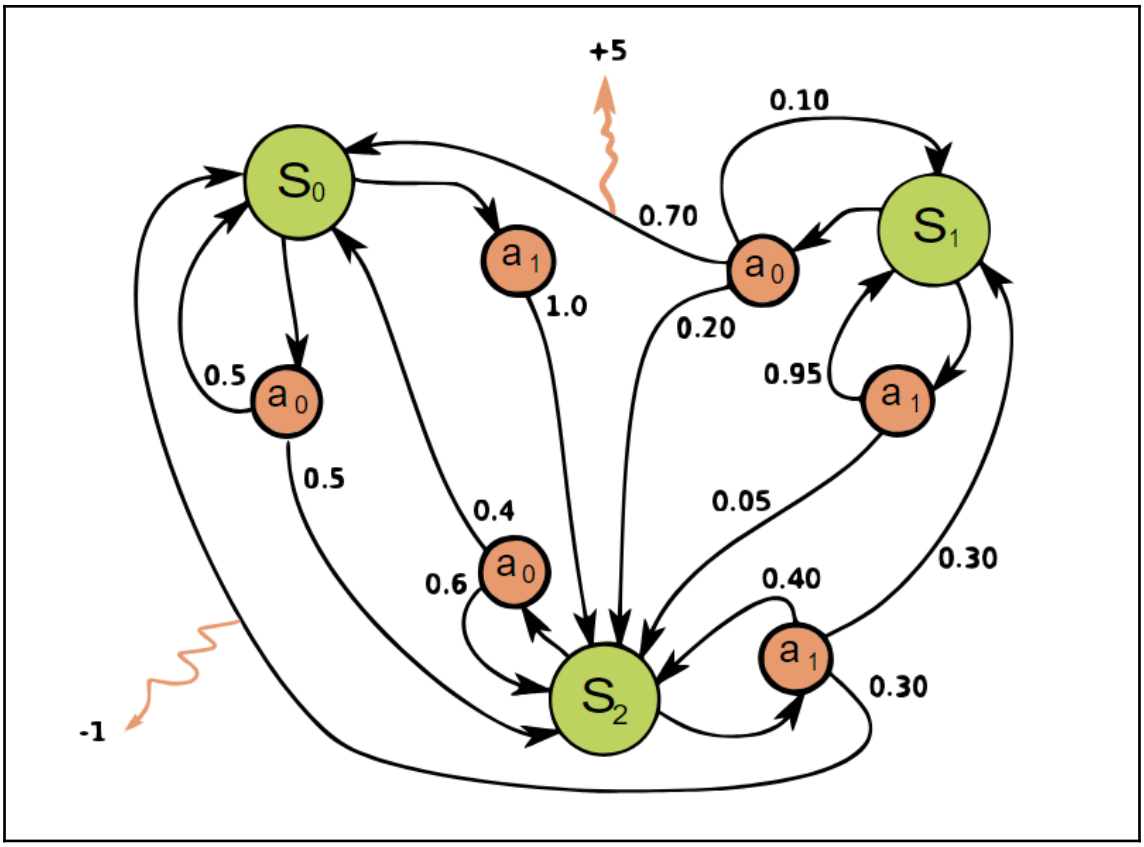

Unity 2018.2.13f1 Download Assistant
Choose Components
Choose which Unity components you want to download and install.
Unity 2018.2.13f1
Documentation
Android Build Support
iOS Build Support
tvOS Build Support
Linux Build Support
Mac Build Support (Mono)
UWP Build Support (.NET)
UWP Build Support (IL2CPP)
Vuforia Augmented Reality Support
WebGL Build Support
Windows Build Support (IL2CPP)
Facebook Gameroom Build Support
Description
Facebook SDK for Gameroom and WebGL
Download size: 33M
Install space required: 3.9GB
Unity 2018.2.13f1 Download Assistant
< Back
Next >
Cancel


Unity 2018.2.13f1 Download Assistant
Choose Download and Install locations
Specify where to download and install files.
Specify location of files downloaded during installation
Download files to temporary location (will automatically be removed when done)
Download to:
C:\Users\Micheal\Downloads
Browse...
Unity install folder
C:\Unity2018.2.13f1
Browse...
Total space required: 5.0 GB
Space available: 277.7 GB
Unity 2018.2.13f1 Download Assistant
< Back
Next >
Cancel

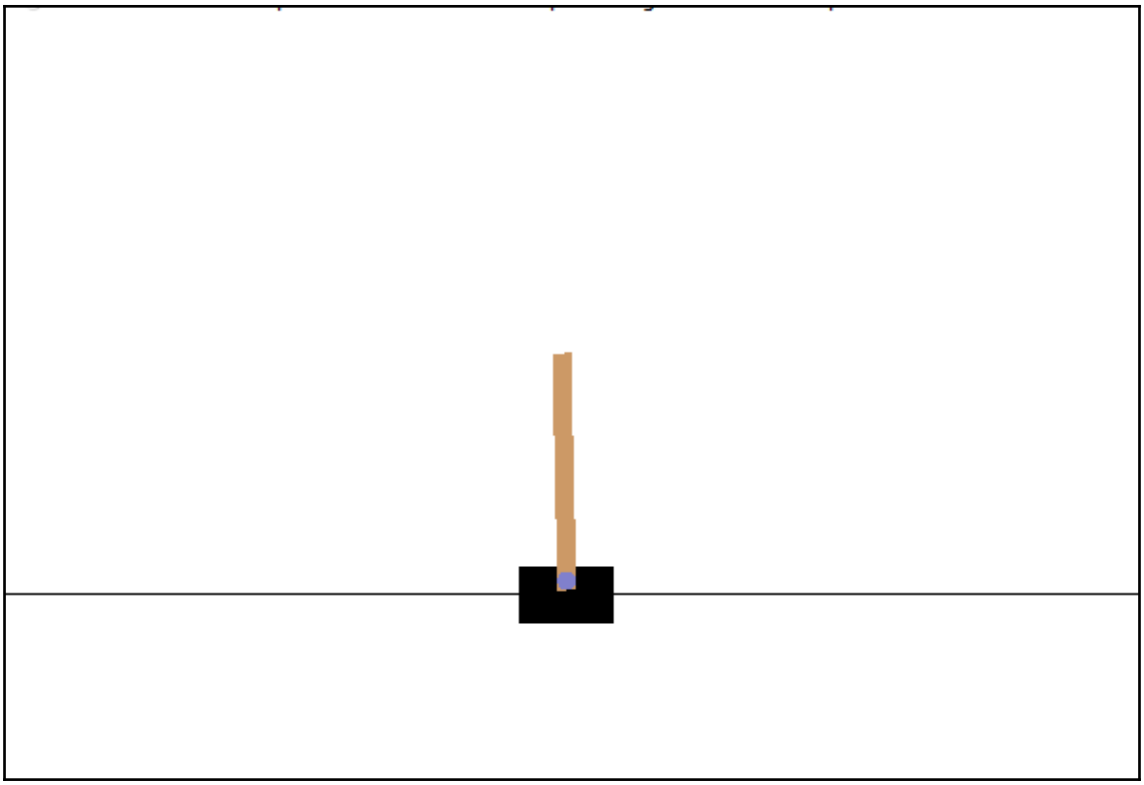

Scene
Game
Asset Store
Display 1
Free Aspect
Scale
1x
Maximize On Play
Mute Audio
Stats
Gizmos
Connection
Subscriptions
Publish
localhost
Connect
Disconnect
chat
chatout
Subscribe
Unsubscribe
chat
chatin
hello
Send
1
2
3

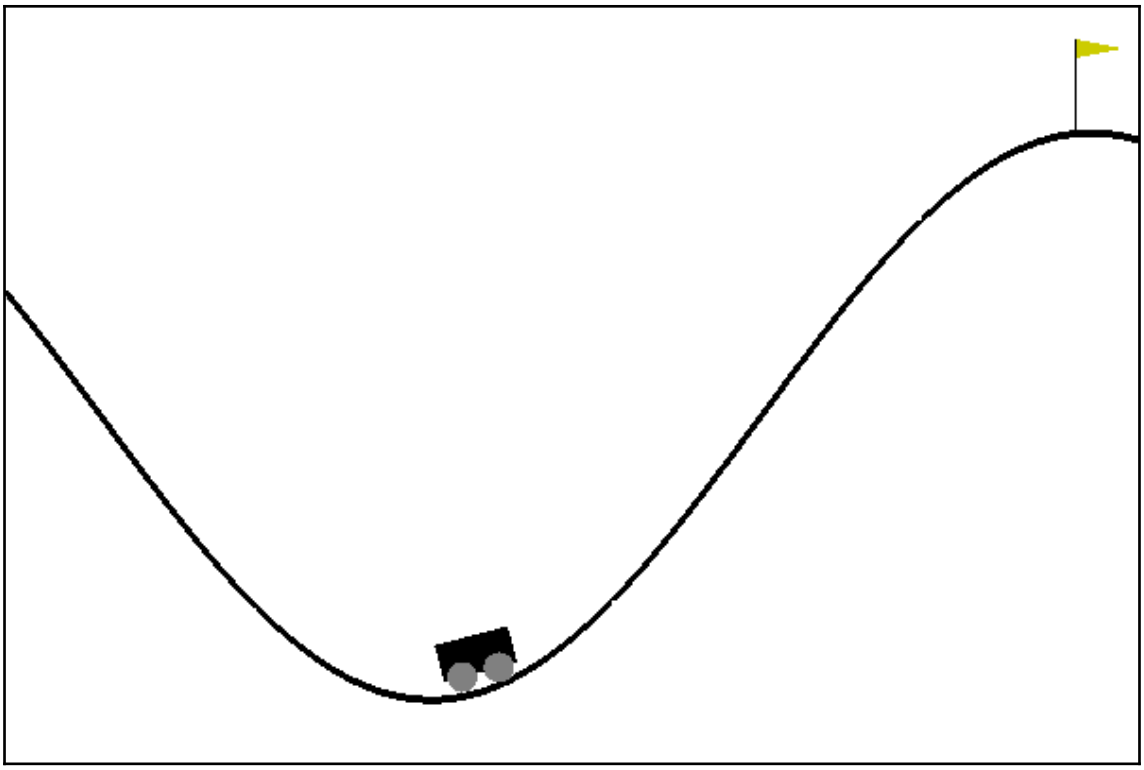
Chapter 5: Introducing DRL




+5
0.10
S0
0.70
a1
S1
a0
1.0
0.20
0.5
a0
0.95
a1
0.5
0.4
0.05
0.6
a0
0.30
0.40
a1
S2
0.30
-1

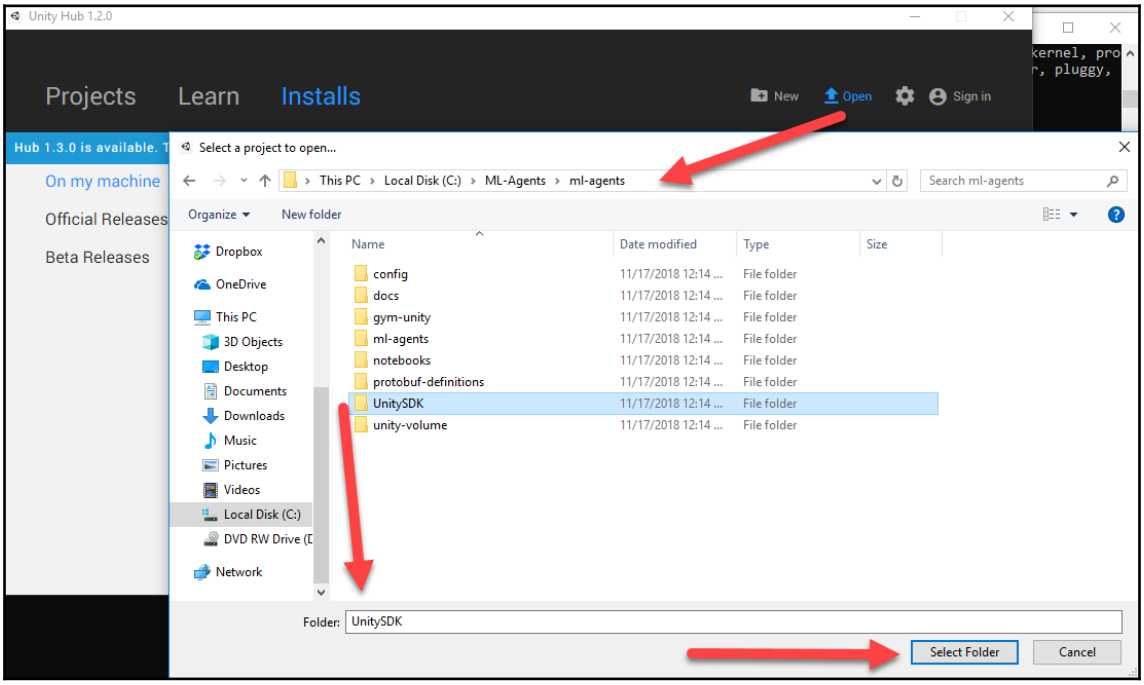
(Left)
SFFF
FHFH
FFFH
HFFG

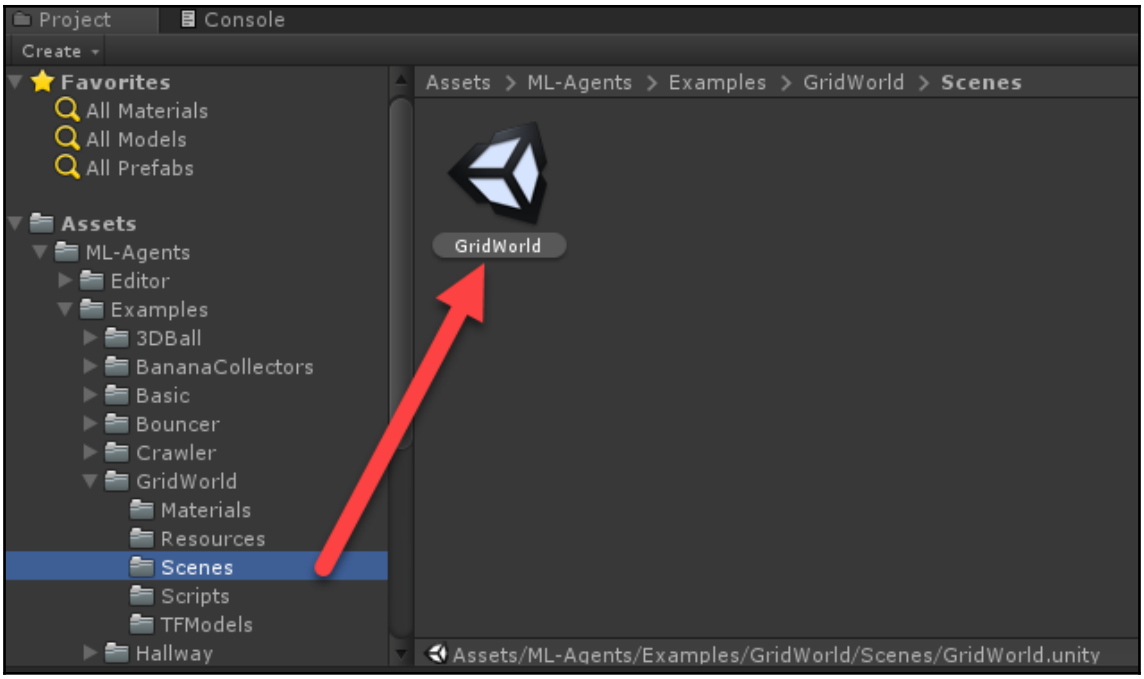


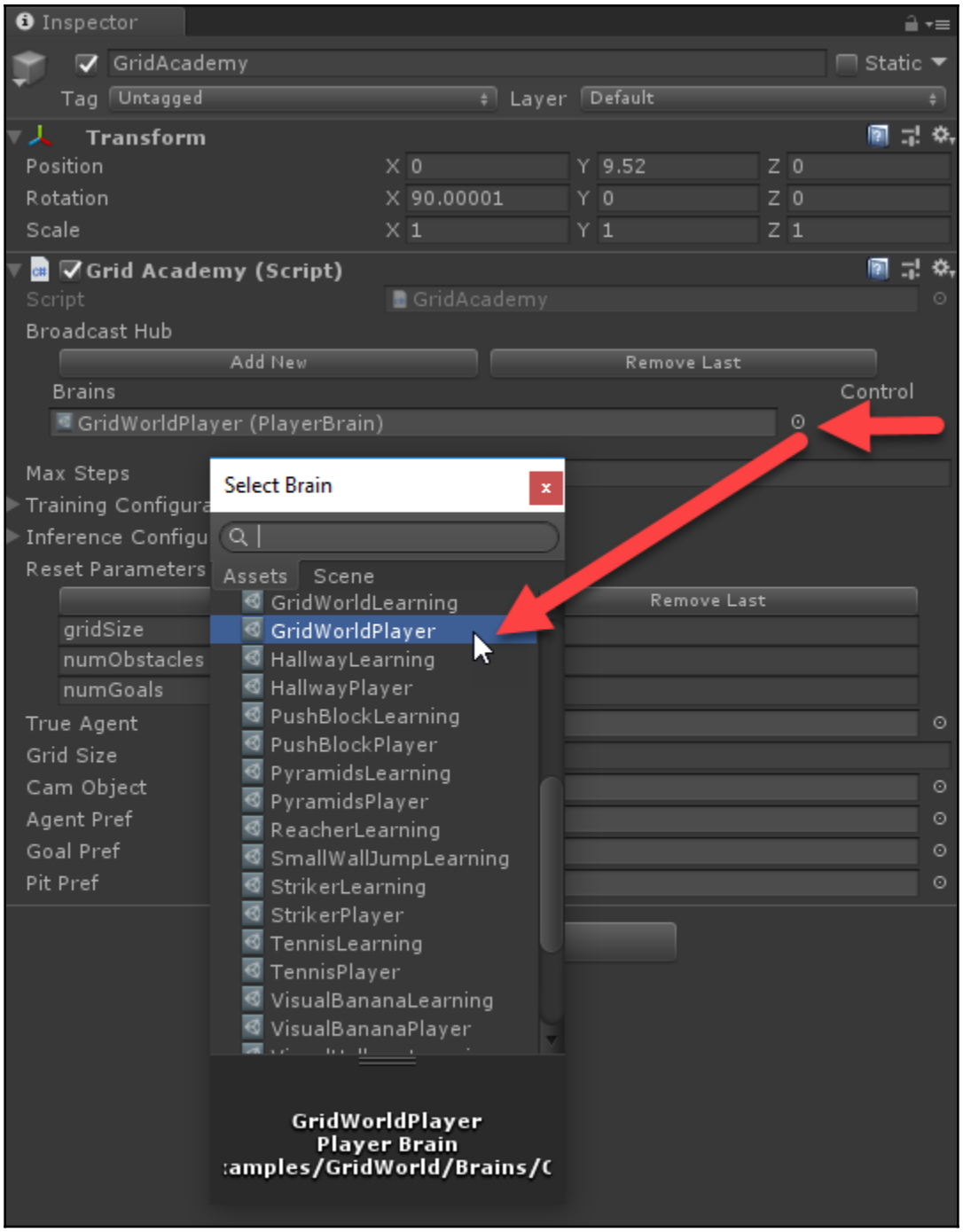


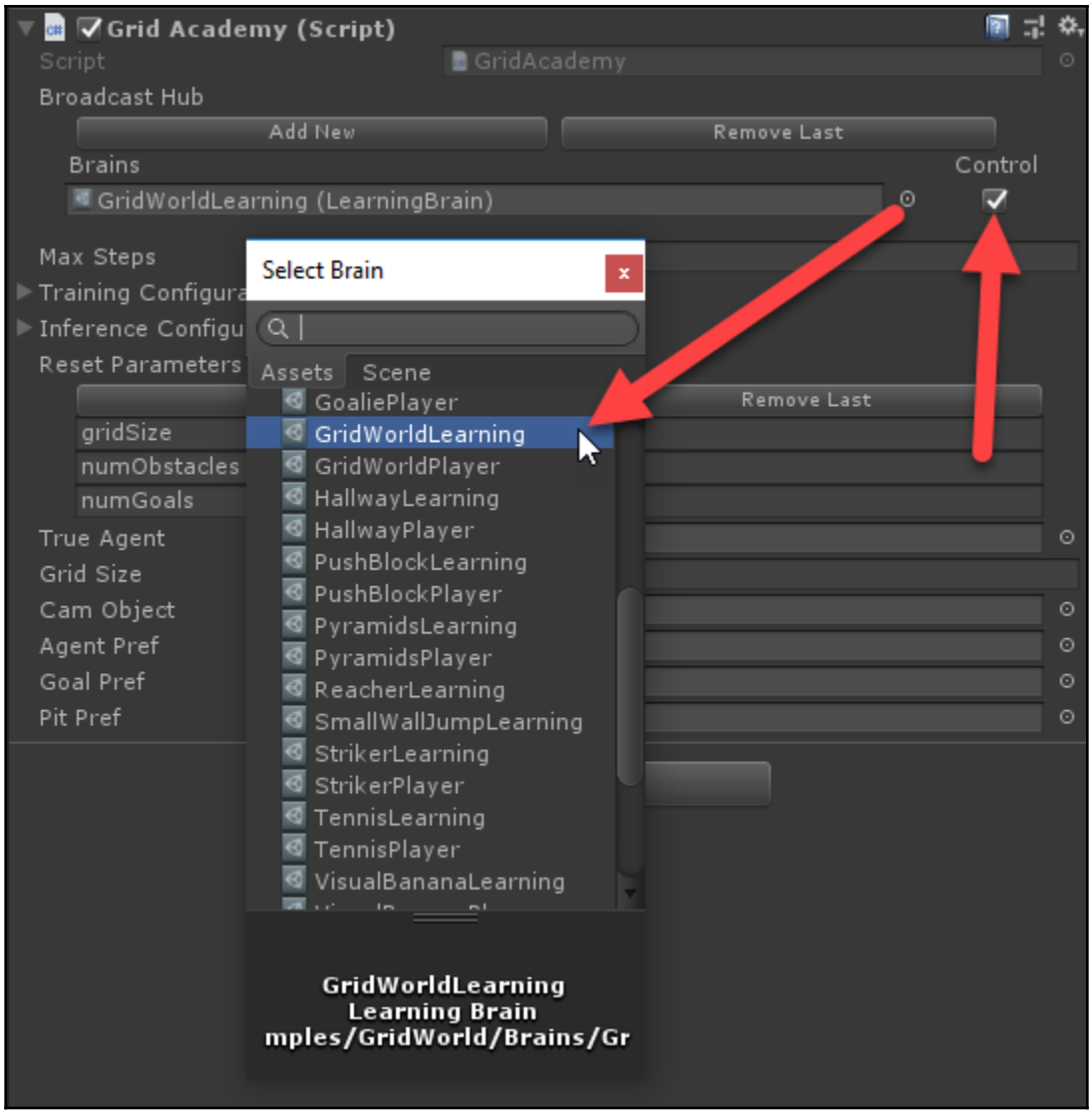
000 5 1

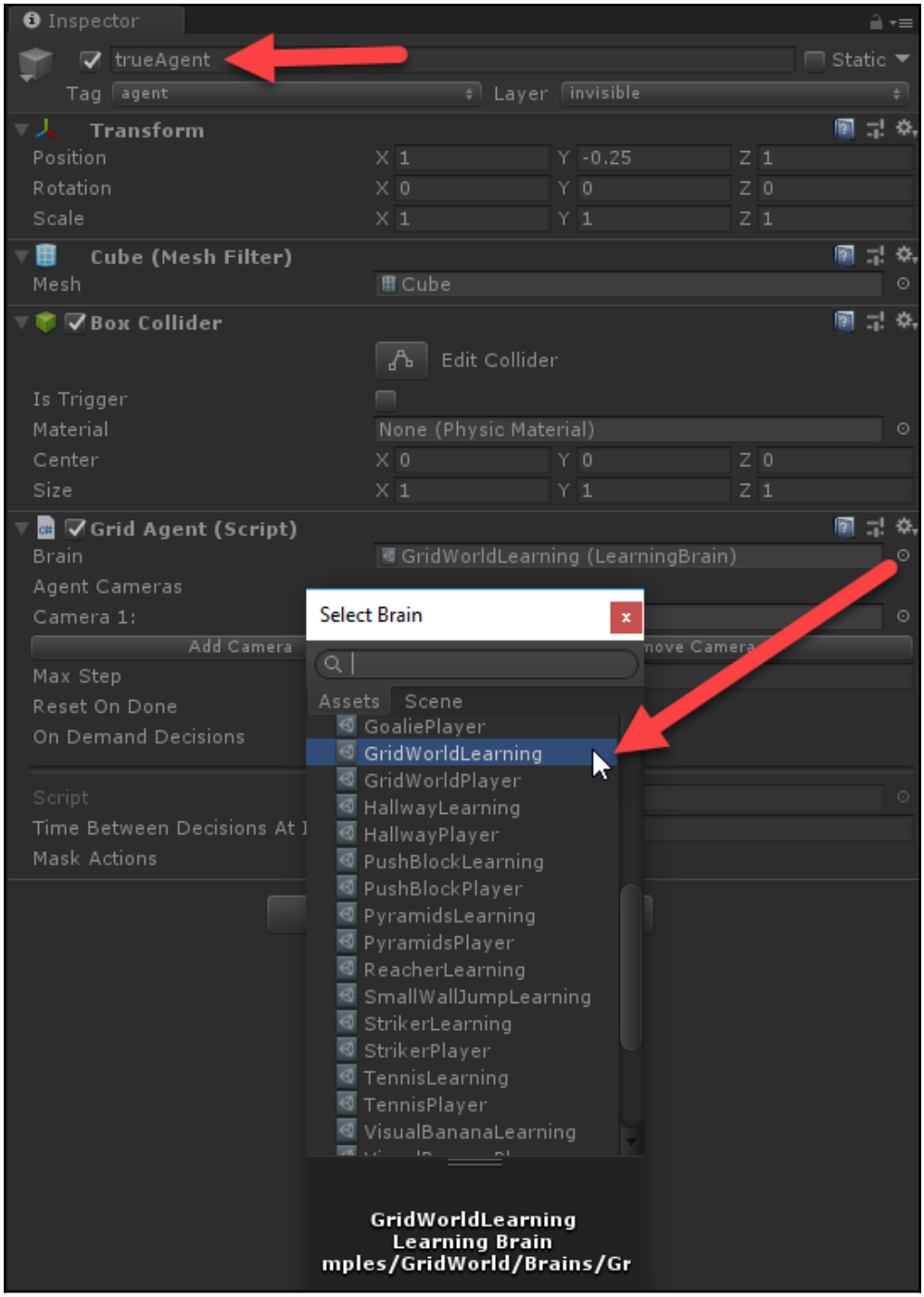
Chapter 6: Unity ML-Agents

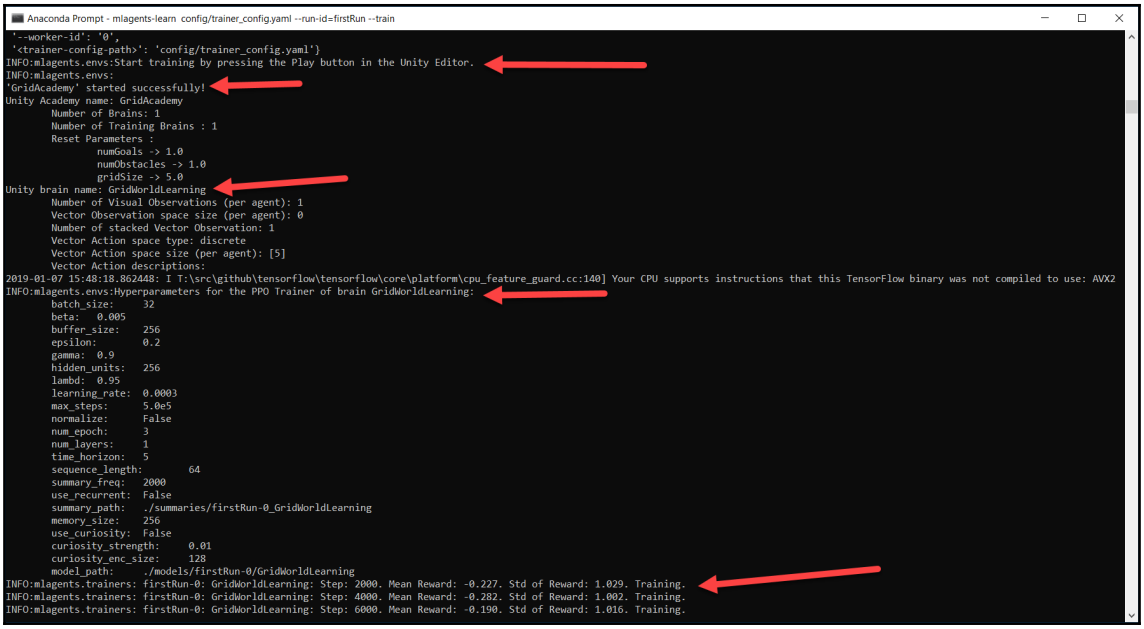


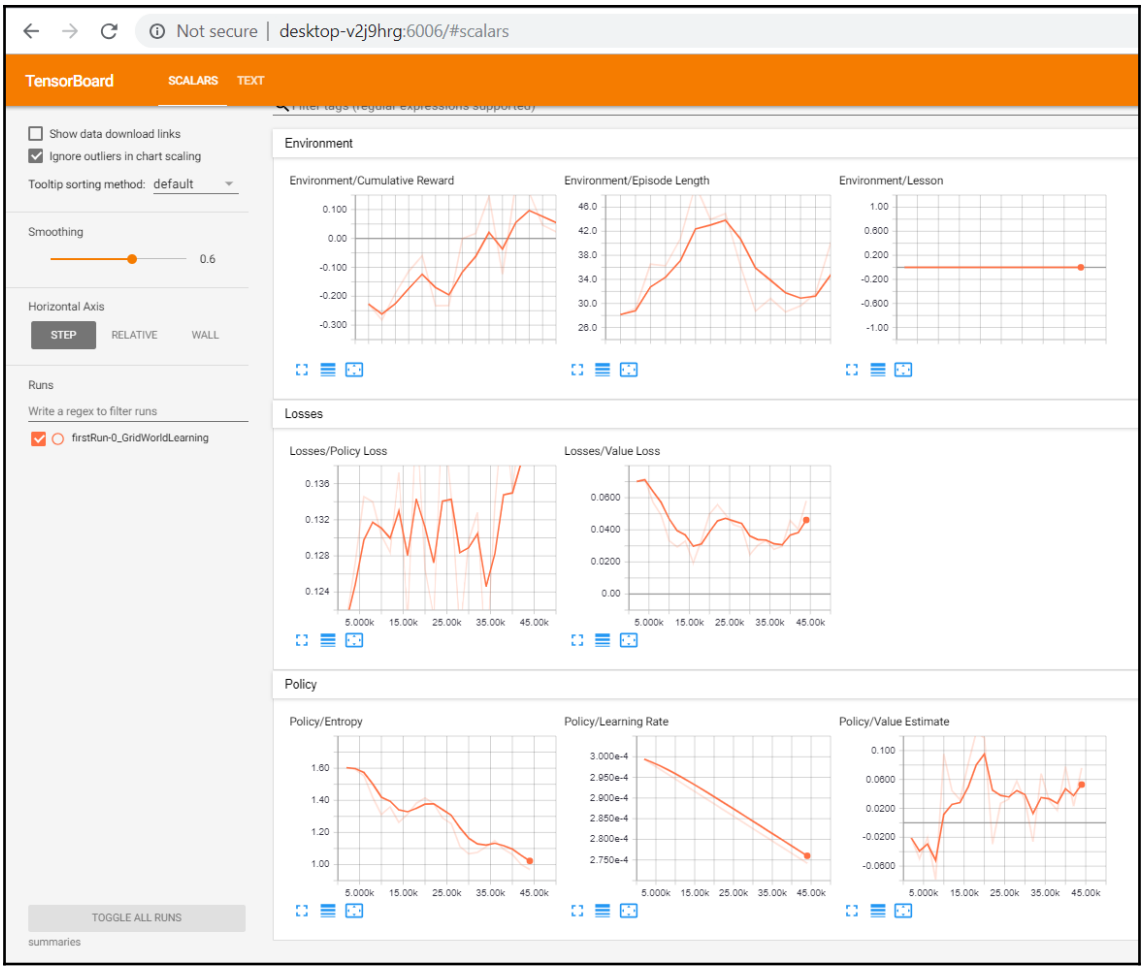

Project
Console
Create
Favorites
All Materials
All Models
All Prefabs
Assets
ML-Agents
Editor
Examples
3DBall
BananaCollectors
Basic
Bouncer
Crawler
GridWorld
Materials
Resources
Scenes
Scripts
TFModels
Hallway
Assets > ML-Agents > Examples > GridWorld > Scenes
GridWorld
Assets/ML-Agents/Examples/GridWorld/Scenes/GridWorld.unity

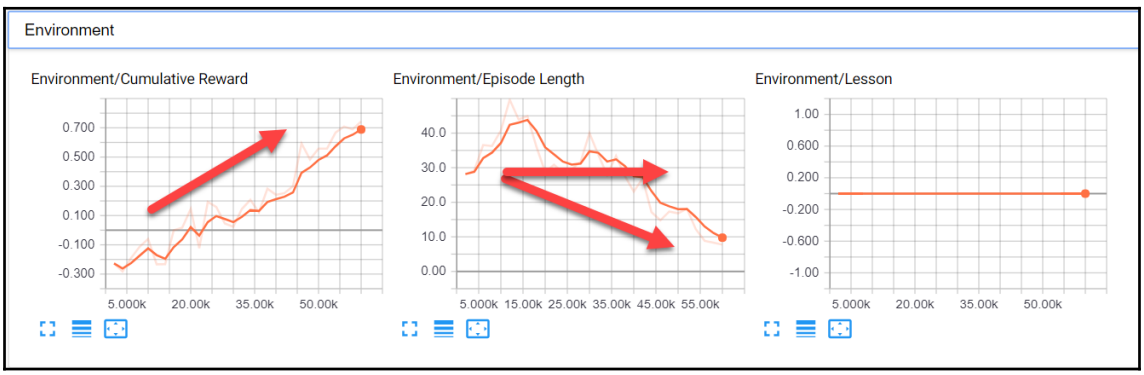

Inspector
GridAcademy
Static
Tag
Untagged
Layer
Default
Transform
Position
X 0
Y 9.52
Z 0
Rotation
X 90.00001
Y 0
Z 0
Scale
X 1
Y 1
Z 1
Grid Academy (Script)
Script
GridAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
GridWorldPlayer (PlayerBrain)
Max Steps
Training Configura
Inference Configu
Reset Parameters
Remove Last
gridSize
numObstacles
numGoals
True Agent
Grid Size
Cam Object
Agent Pref
Goal Pref
Pit Pref
Select Brain
Assets
Scene
GridWorldLearning
GridWorldPlayer
HallwayLearning
HallwayPlayer
PushBlockLearning
PushBlockPlayer
PyramidsLearning
PyramidsPlayer
ReacherLearning
SmallWallJumpLearning
StrikerLearning
StrikerPlayer
TennisLearning
TennisPlayer
VisualBananaLearning
VisualBananaPlayer
GridWorldPlayer
Player Brain
:amples/GridWorld/Brains/C

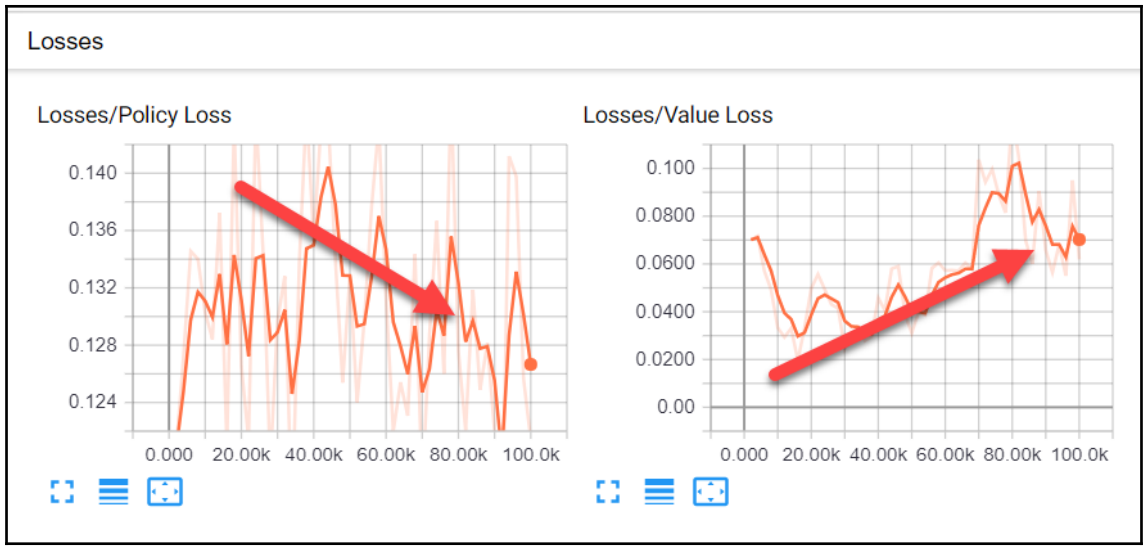

Grid Academy (Script)
Script
GridAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
GridWorldLearning (LearningBrain)
Max Steps
Training Configura
Inference Configu
Reset Parameters
Select Brain
Assets
Scene
GoaliePlayer
GridWorldLearning
GridWorldPlayer
HallwayLearning
HallwayPlayer
PushBlockLearning
PushBlockPlayer
PyramidsLearning
PyramidsPlayer
ReacherLearning
SmallWallJumpLearning
StrikerLearning
StrikerPlayer
TennisLearning
TennisPlayer
VisualBananaLearning
Remove Last
gridSize
numObstacles
numGoals
True Agent
Grid Size
Cam Object
Agent Pref
Goal Pref
Pit Pref
GridWorldLearning
Learning Brain
mples/GridWorld/Brains/Gr

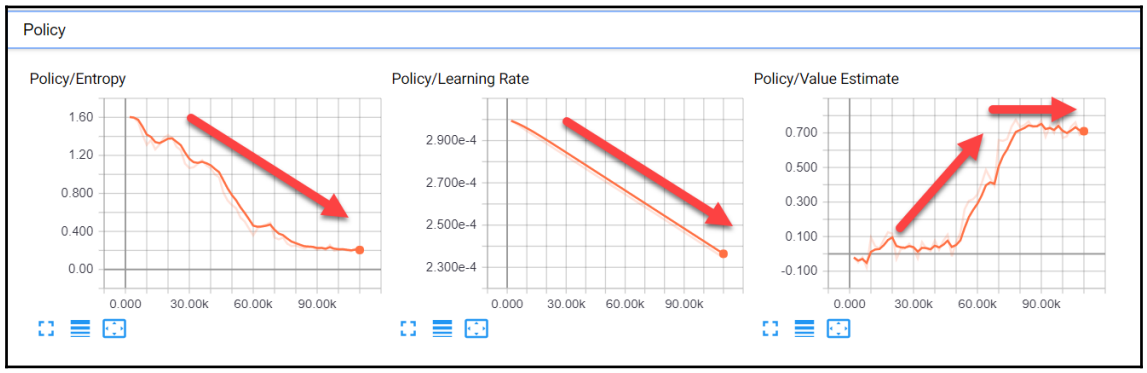

Inspector
trueAgent
Static
Tag agent
Layer invisible
Transform
Position X 1 Y -0.25 Z 1
Rotation X 0 Y 0 Z 0
Scale X 1 Y 1 Z 1
Cube (Mesh Filter)
Mesh Cube
Box Collider
Edit Collider
Is Trigger
Material None (Physic Material)
Center X 0 Y 0 Z 0
Size X 1 Y 1 Z 1
Grid Agent (Script)
Brain GridWorldLearning (LearningBrain)
Agent Cameras
Camera 1:
Add Camera
Max Step
Reset On Done
On Demand Decisions
Script
Time Between Decisions At
Mask Actions
Select Brain
Assets
Scene
GoaliePlayer
GridWorldLearning
GridWorldPlayer
HallwayLearning
HallwayPlayer
PushBlockLearning
PushBlockPlayer
PyramidsLearning
PyramidsPlayer
ReacherLearning
SmallWallJumpLearning
StrikerLearning
StrikerPlayer
TennisLearning
TennisPlayer
VisualBananaLearning
GridWorldLearning
Learning Brain
mples/GridWorld/Brains/Gr

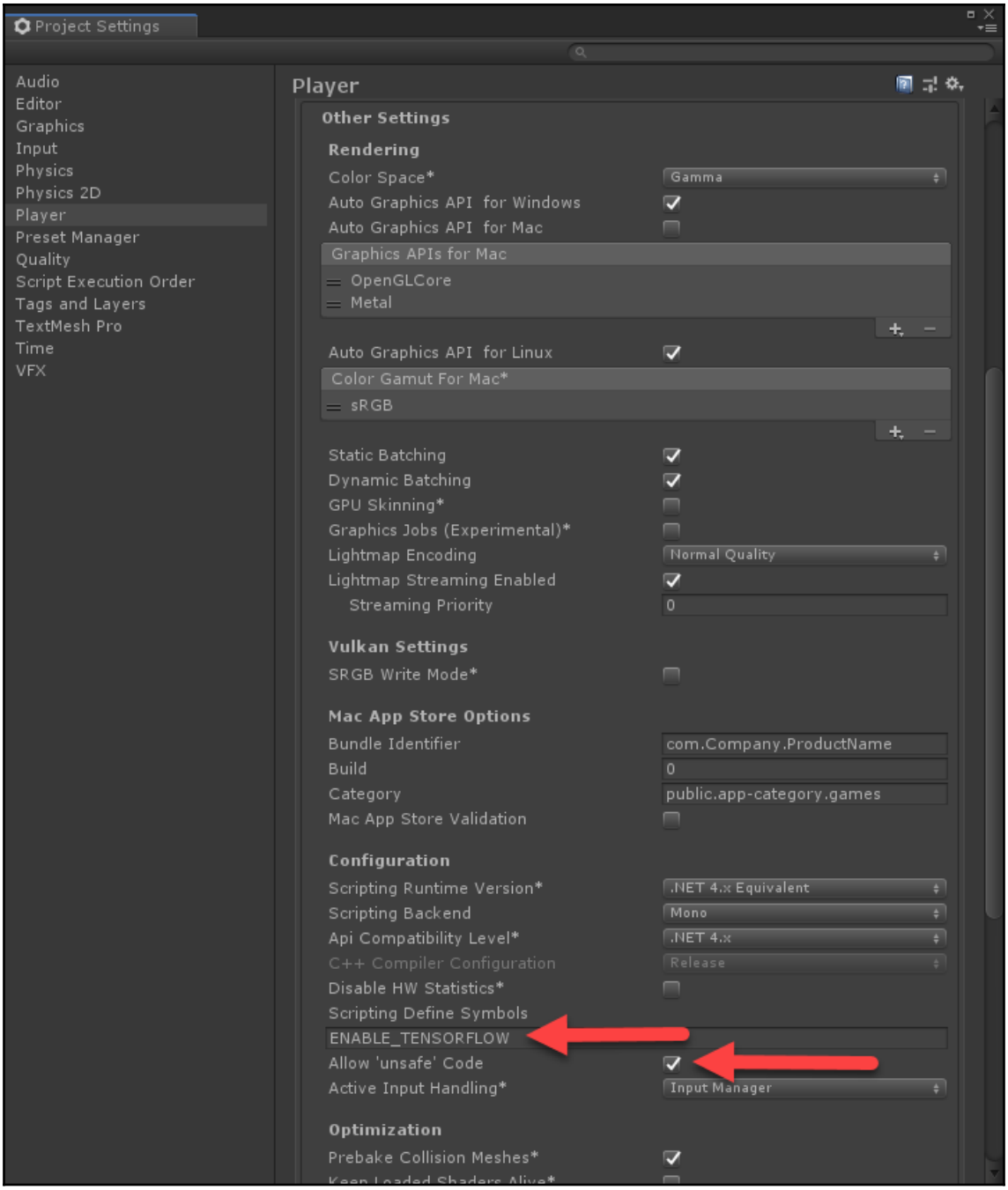

Anaconda Prompt - mlagents-learn config/trainer_config.yaml --run-id=firstRun --train
'--worker-id': '0',
'<trainer-config-path>': 'config/trainer_config.yaml'}
INFO:mlagents.envs:Start training by pressing the Play button in the Unity Editor.
INFO:mlagents.envs:
'GridAcademy' started successfully!
Unity Academy name: GridAcademy
Number of Brains: 1
Number of Training Brains : 1
Reset Parameters :
numGoals -> 1.0
numObstacles -> 1.0
gridSize -> 5.0
Unity brain name: GridWorldLearning
Number of Visual Observations (per agent): 1
Vector Observation space size (per agent): 0
Number of stacked Vector Observation: 1
Vector Action space type: discrete
Vector Action space size (per agent): [5]
Vector Action descriptions:
2019-01-07 15:48:18.862448: I T:\src\github\tensorflow\tensorflow\core\platform\cpu_feature_guard.cc:140] Your CPU supports instructions that this TensorFlow binary was not compiled to use: AVX2
INFO:mlagents.envs:Hyperparameters for the PPO Trainer of brain GridWorldLearning:
batch_size: 32
beta: 0.005
buffer_size: 256
epsilon: 0.2
gamma: 0.9
hidden_units: 256
lambd: 0.95
learning_rate: 0.0003
max_steps: 5.0e5
normalize: False
num_epoch: 3
num_layers: 1
time_horizon: 5
sequence_length: 64
summary_freq: 2000
use_recurrent: False
summary_path: ./summaries/firstRun-0_GridWorldLearning
memory_size: 256
use_curiosity: False
curiosity_strength: 0.01
curiosity_enc_size: 128
model_path: ./models/firstRun-0/GridWorldLearning
INFO:mlagents.trainers: firstRun-0: GridWorldLearning: Step: 2000. Mean Reward: -0.227. Std of Reward: 1.029. Training.
INFO:mlagents.trainers: firstRun-0: GridWorldLearning: Step: 4000. Mean Reward: -0.282. Std of Reward: 1.002. Training.
INFO:mlagents.trainers: firstRun-0: GridWorldLearning: Step: 6000. Mean Reward: -0.190. Std of Reward: 1.016. Training.

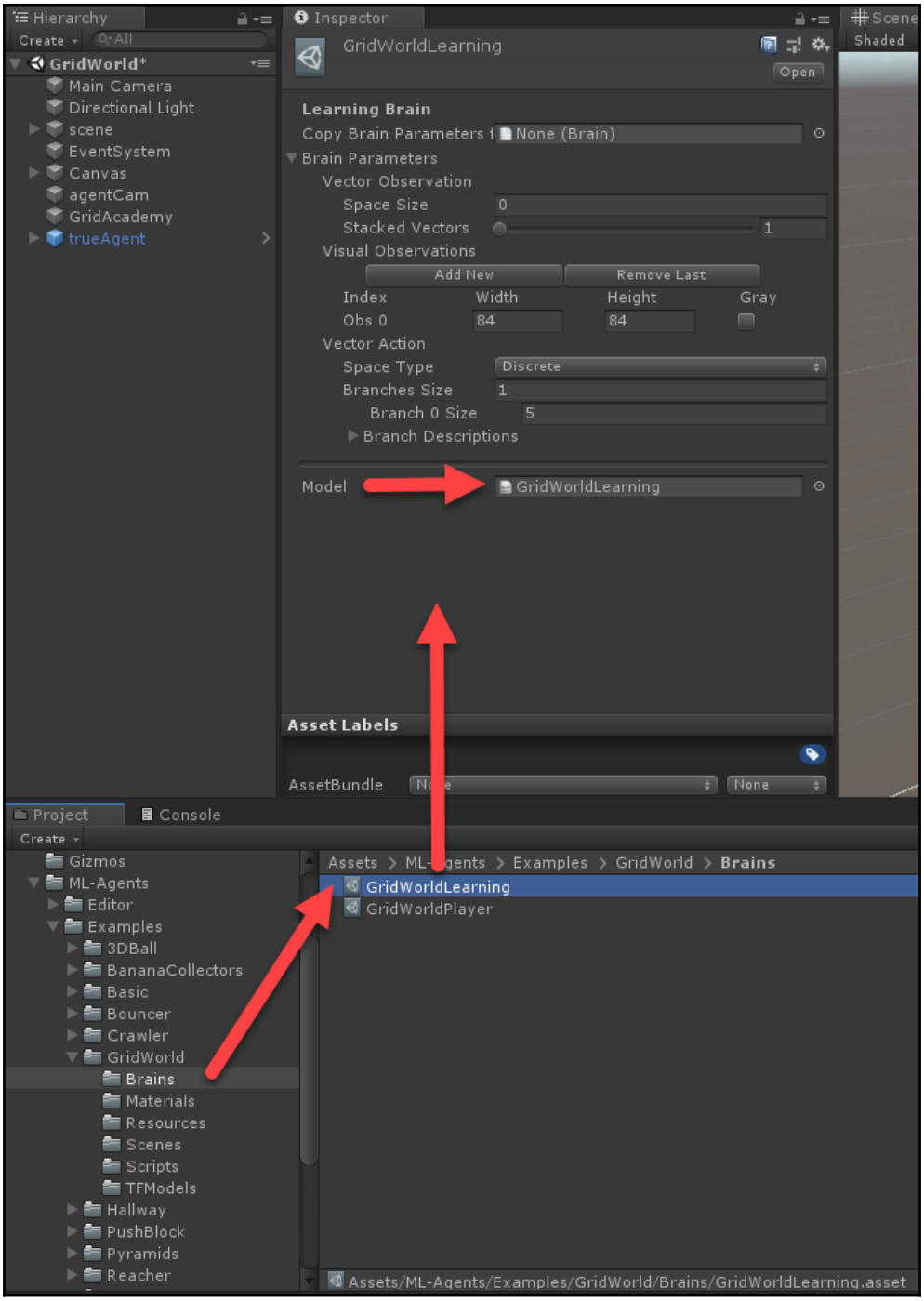

Not secure | desktop-v2j9hrg:6006/#scalars
TensorBoard
SCALARS
TEXT
Show data download links
Ignore outliers in chart scaling
Tooltip sorting method: default
Smoothing
0.6
Horizontal Axis
STEP
RELATIVE
WALL
Runs
Write a regex to filter runs
firstRun-0_GridWorldLearning
TOGGLE ALL RUNS
summaries
Environment
Environment/Cumulative Reward
Environment/Episode Length
Environment/Lesson
Losses
Losses/Policy Loss
Losses/Value Loss
Policy
Policy/Entropy
Policy/Learning Rate
Policy/Value Estimate

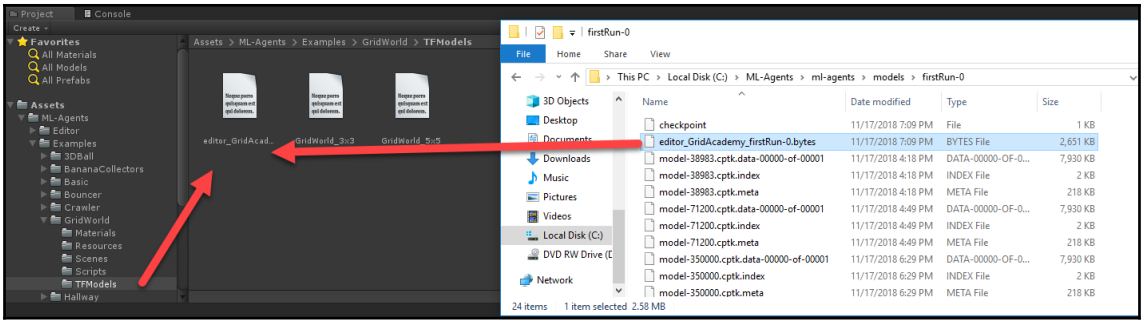

Environment
Environment/Cumulative Reward
Environment/Episode Length
Environment/Lesson

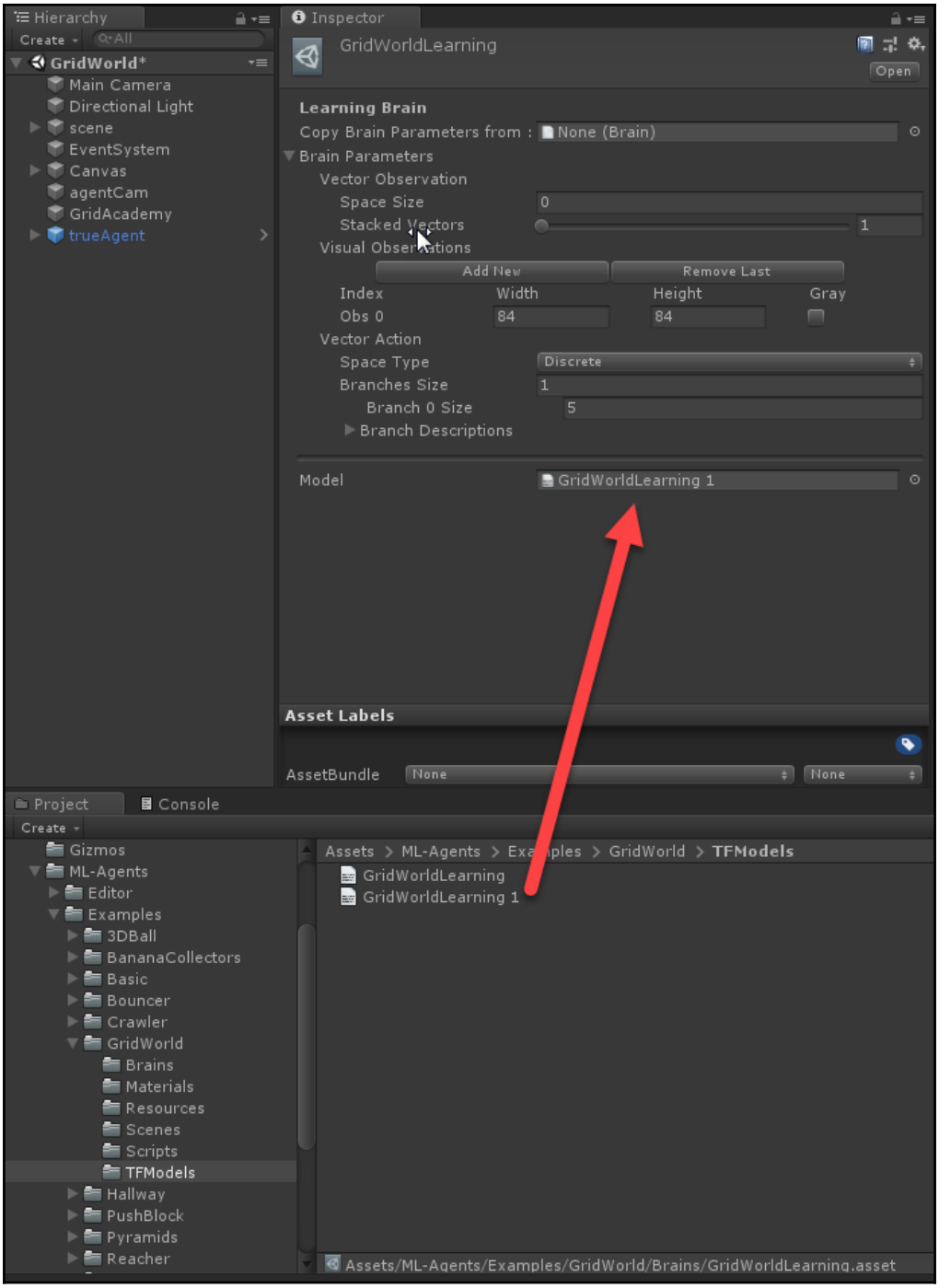

Losses
Losses/Policy Loss
0.140
0.136
0.132
0.128
0.124
0.000
20.00k
40.00k
60.00k
80.00k
100.0k
Losses/Value Loss
0.100
0.0800
0.0600
0.0400
0.0200
0.00
0.000
20.00k
40.00k
60.00k
80.00k
100.0k


Policy
Policy/Entropy
1.60
1.20
0.800
0.400
0.00
0.000
30.00k
60.00k
90.00k
Policy/Learning Rate
2.900e-4
2.700e-4
2.500e-4
2.300e-4
0.000
30.00k
60.00k
90.00k
Policy/Value Estimate
0.700
0.500
0.300
0.100
-0.100
0.000
30.00k
60.00k
90.00k

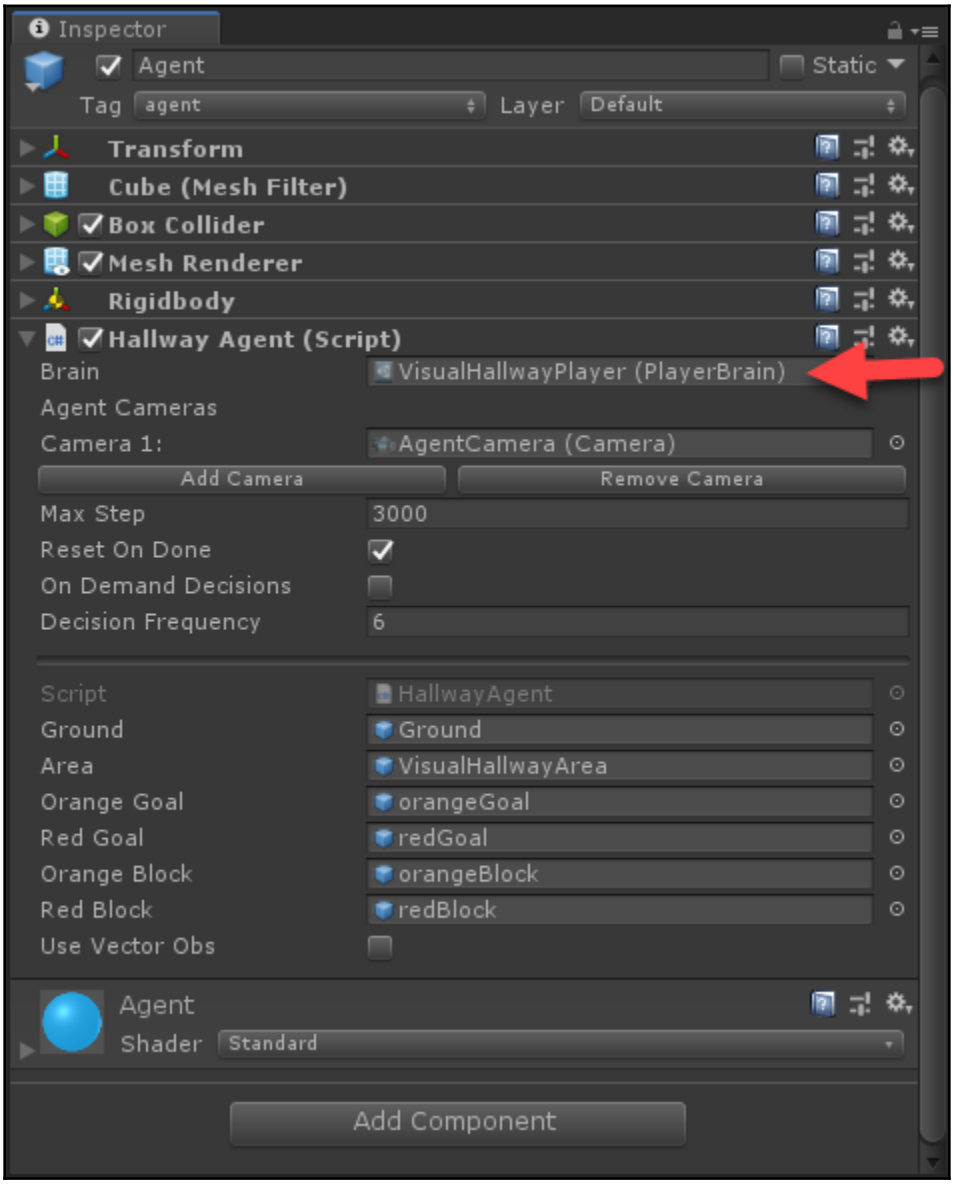

Project Settings
Audio
Editor
Graphics
Input
Physics
Physics 2D
Player
Preset Manager
Quality
Script Execution Order
Tags and Layers
TextMesh Pro
Time
VFX
Player
Other Settings
Rendering
Color Space*
Gamma
Auto Graphics API for Windows
Auto Graphics API for Mac
Graphics APIs for Mac
OpenGLCore
Metal
Auto Graphics API for Linux
Color Gamut For Mac*
sRGB
Static Batching
Dynamic Batching
GPU Skinning*
Graphics Jobs (Experimental)*
Lightmap Encoding
Normal Quality
Lightmap Streaming Enabled
Streaming Priority
0
Vulkan Settings
SRGB Write Mode*
Mac App Store Options
Bundle Identifier
com.Company.ProductName
Build
0
Category
public.app-category.games
Mac App Store Validation
Configuration
Scripting Runtime Version*
.NET 4.x Equivalent
Scripting Backend
Mono
Api Compatibility Level*
.NET 4.x
C++ Compiler Configuration
Release
Disable HW Statistics*
Scripting Define Symbols
ENABLE_TENSORFLOW
Allow 'unsafe' Code
Active Input Handling*
Input Manager
Optimization
Prebake Collision Meshes*

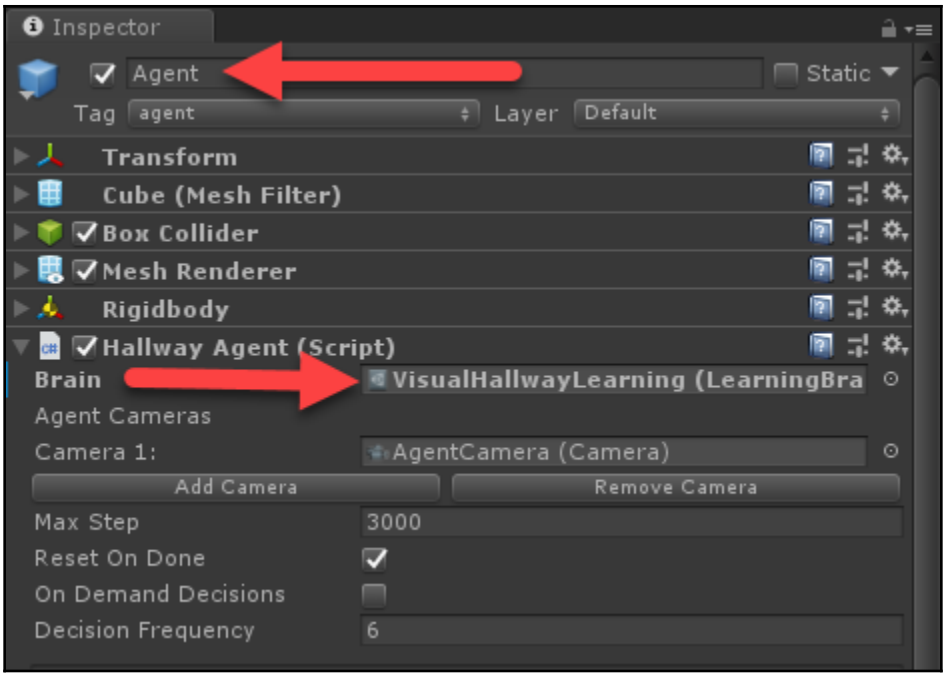

Hierarchy
Create
GridWorld*
Main Camera
Directional Light
scene
EventSystem
Canvas
agentCam
GridAcademy
trueAgent
Inspector
GridWorldLearning
Open
Learning Brain
Copy Brain Parameters f
None (Brain)
Brain Parameters
Vector Observation
Space Size
0
Stacked Vectors
1
Visual Observations
Add New
Remove Last
Index
Width
Height
Gray
Obs 0
84
84
Vector Action
Space Type
Discrete
Branches Size
1
Branch 0 Size
5
Branch Descriptions
Model
GridWorldLearning
Asset Labels
AssetBundle
None
Scene
Shaded
Project
Console
Create
Gizmos
ML-Agents
Editor
Examples
3DBall
BananaCollectors
Basic
Bouncer
Crawler
GridWorld
Brains
Materials
Resources
Scenes
Scripts
TFModels
Hallway
PushBlock
Pyramids
Reacher
Assets > ML-Agents > Examples > GridWorld > Brains
GridWorldLearning
GridWorldPlayer
Assets/ML-Agents/Examples/GridWorld/Brains/GridWorldLearning.asset

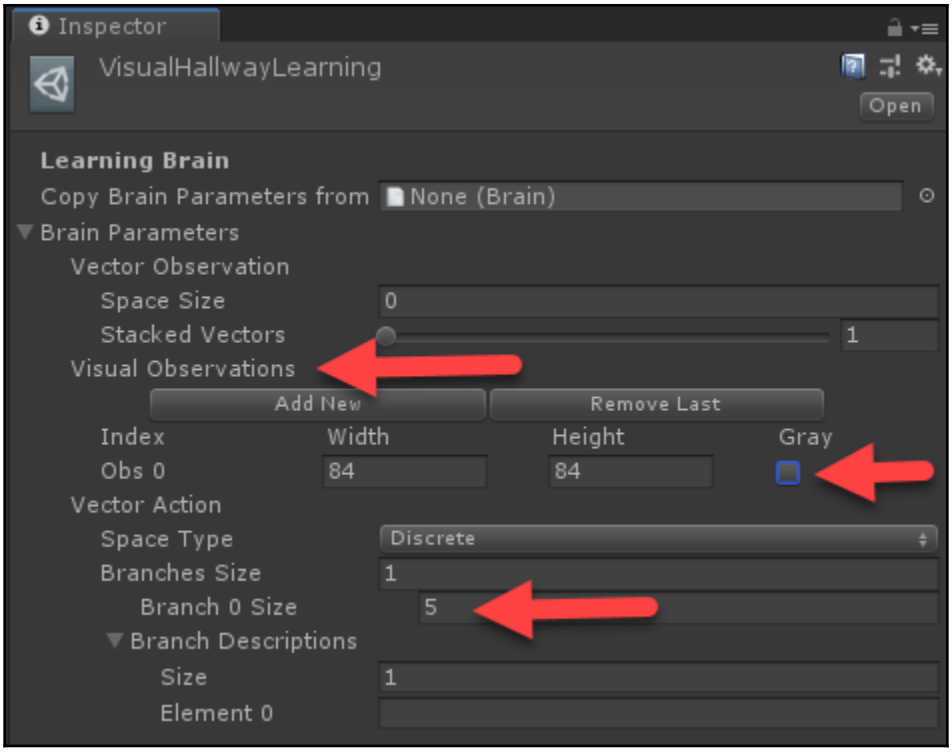

Project
Console
Create
Favorites
All Materials
All Models
All Prefabs
Assets
ML-Agents
Editor
Examples
3DBall
BananaCollectors
Basic
Bouncer
Crawler
GridWorld
Materials
Resources
Scenes
Scripts
TFModels
Hallway
Assets > ML-Agents > Examples > GridWorld > TFModels
editor_GridAcad...
GridWorld_3x3
GridWorld_5x5
firstRun-0
File
Home
Share
View
This PC > Local Disk (C:) > ML-Agents > ml-agents > models > firstRun-0
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
DVD RW Drive (D
Network
Name
Date modified
Type
Size
checkpoint 11/17/2018 7:09 PM File 1 KB
editor_GridAcademy_firstRun-0.bytes 11/17/2018 7:09 PM BYTES File 2,651 KB
model-38983.cptk.data-00000-of-00001 11/17/2018 4:18 PM DATA-00000-OF-0... 7,930 KB
model-38983.cptk.index 11/17/2018 4:18 PM INDEX File 2 KB
model-38983.cptk.meta 11/17/2018 4:18 PM META File 218 KB
model-71200.cptk.data-00000-of-00001 11/17/2018 4:49 PM DATA-00000-OF-0... 7,930 KB
model-71200.cptk.index 11/17/2018 4:49 PM INDEX File 2 KB
model-71200.cptk.meta 11/17/2018 4:49 PM META File 218 KB
model-350000.cptk.data-00000-of-00001 11/17/2018 6:29 PM DATA-00000-OF-0... 7,930 KB
model-350000.cptk.index 11/17/2018 6:29 PM INDEX File 2 KB
model-350000.cptk.meta 11/17/2018 6:29 PM META File 218 KB
24 items
1 item selected 2.58 MB

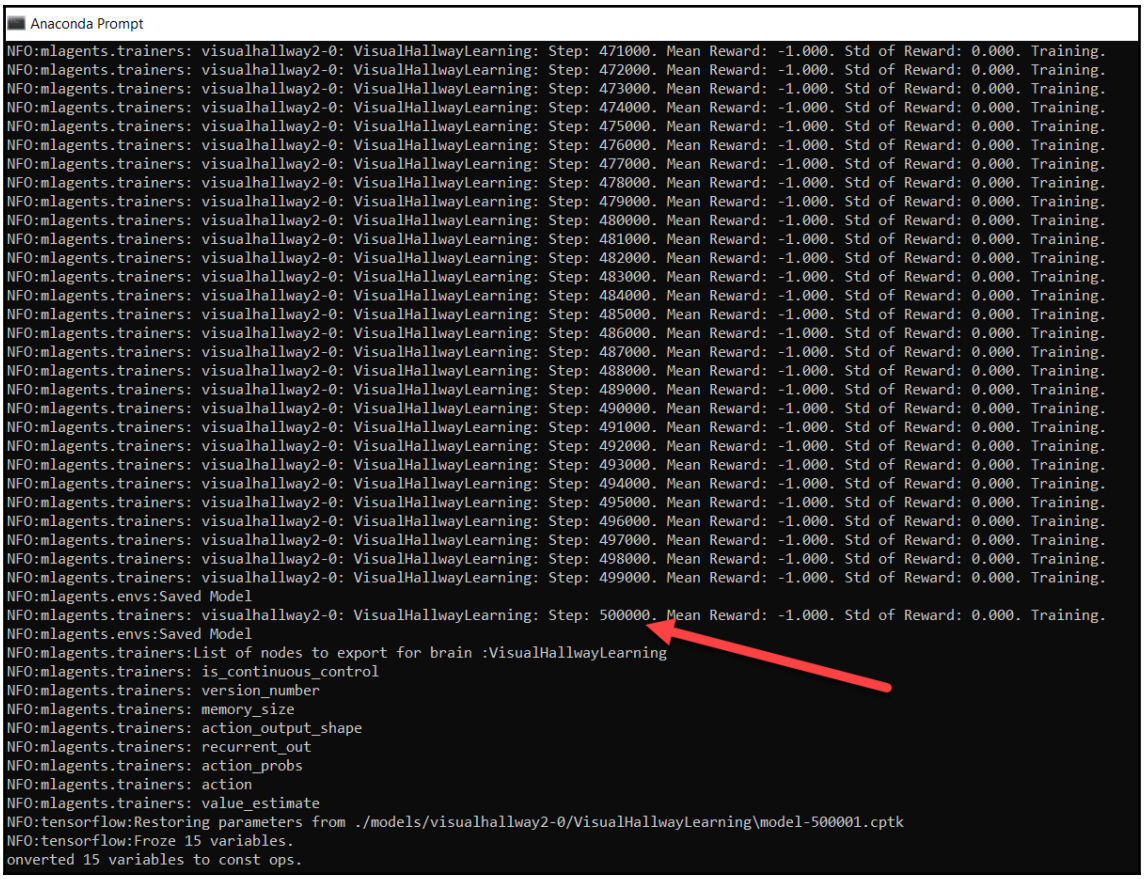

Hierarchy
Create
All
GridWorld*
Main Camera
Directional Light
scene
EventSystem
Canvas
agentCam
GridAcademy
trueAgent
Inspector
GridWorldLearning
Open
Learning Brain
Copy Brain Parameters from :
None (Brain)
Brain Parameters
Vector Observation
Space Size
0
Stacked Vectors
1
Visual Observations
Add New
Remove Last
Index
Width
Height
Gray
Obs 0
84
84
Vector Action
Space Type
Discrete
Branches Size
1
Branch 0 Size
5
Branch Descriptions
Model
GridWorldLearning 1
Asset Labels
AssetBundle
None
None
Project
Console
Create
Gizmos
ML-Agents
Editor
Examples
3DBall
BananaCollectors
Basic
Bouncer
Crawler
GridWorld
Brains
Materials
Resources
Scenes
Scripts
TFModels
Hallway
PushBlock
Pyramids
Reacher
Assets > ML-Agents > Examples > GridWorld > TFModels
GridWorldLearning
GridWorldLearning 1
Assets/ML-Agents/Examples/GridWorld/Brains/GridWorldLearning.asset

Chapter 7: Agent and the Environment




Inspector
Agent
Static
Tag
agent
Layer
Default
Transform
Cube (Mesh Filter)
Box Collider
Mesh Renderer
Rigidbody
Hallway Agent (Script)
Brain
VisualHallwayLearning (LearningBra
Agent Cameras
Camera 1:
AgentCamera (Camera)
Add Camera
Remove Camera
Max Step
3000
Reset On Done
On Demand Decisions
Decision Frequency
6


Inspector
VisualHallwayLearning
Open
Learning Brain
Copy Brain Parameters from
None (Brain)
Brain Parameters
Vector Observation
Space Size
0
Stacked Vectors
1
Visual Observations
Add New
Remove Last
Index
Width
Height
Gray
Obs 0
84
84
Vector Action
Space Type
Discrete
Branches Size
1
Branch 0 Size
5
Branch Descriptions
Size
1
Element 0


Anaconda Prompt
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 471000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 472000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 473000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
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NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 478000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 479000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 480000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
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NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 483000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 484000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 485000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 486000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
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NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 489000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
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NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 491000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
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NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 494000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
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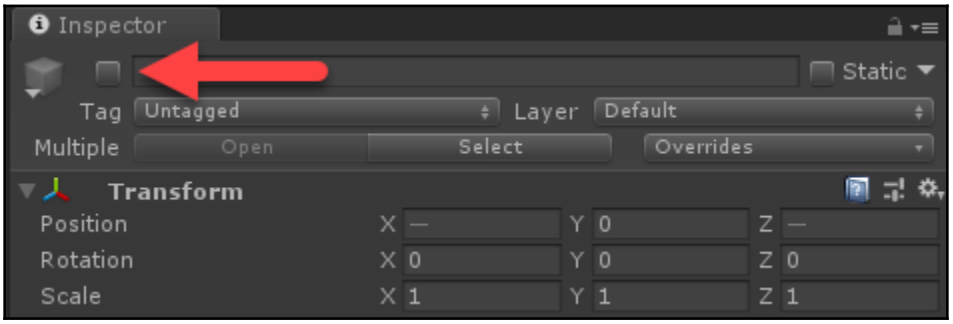
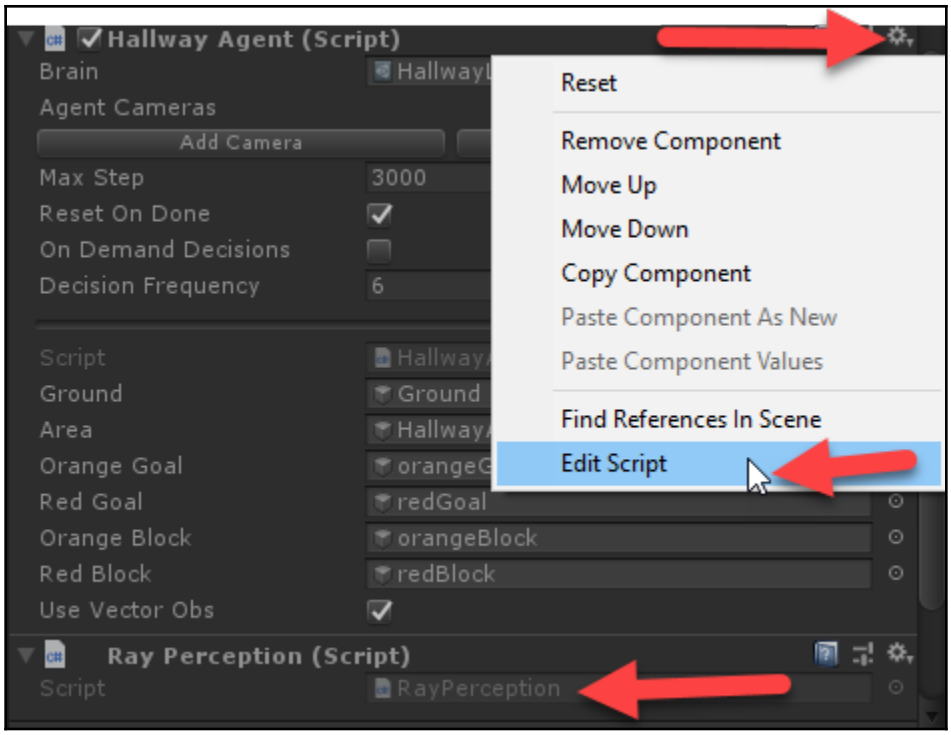
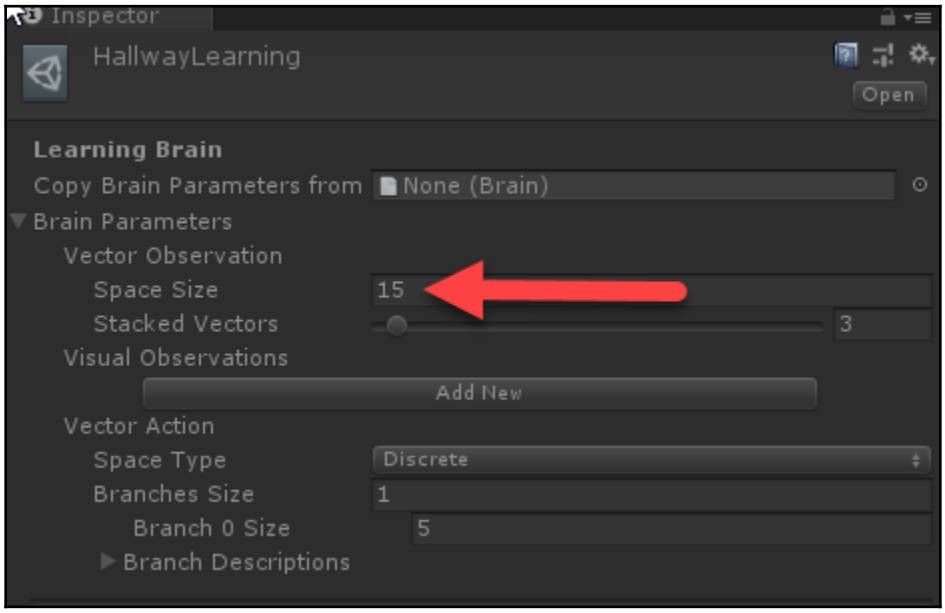
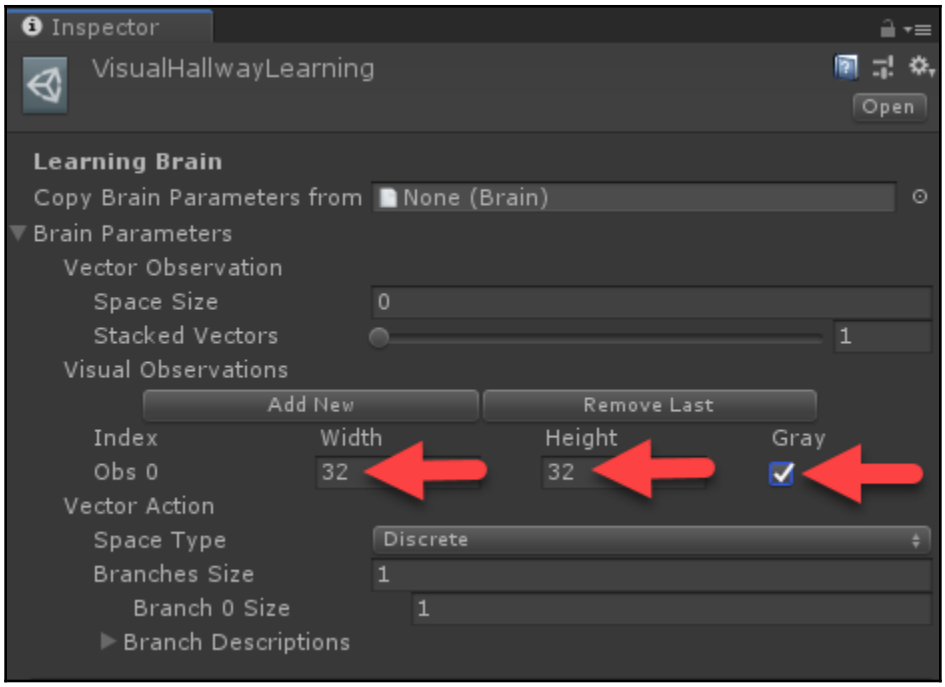
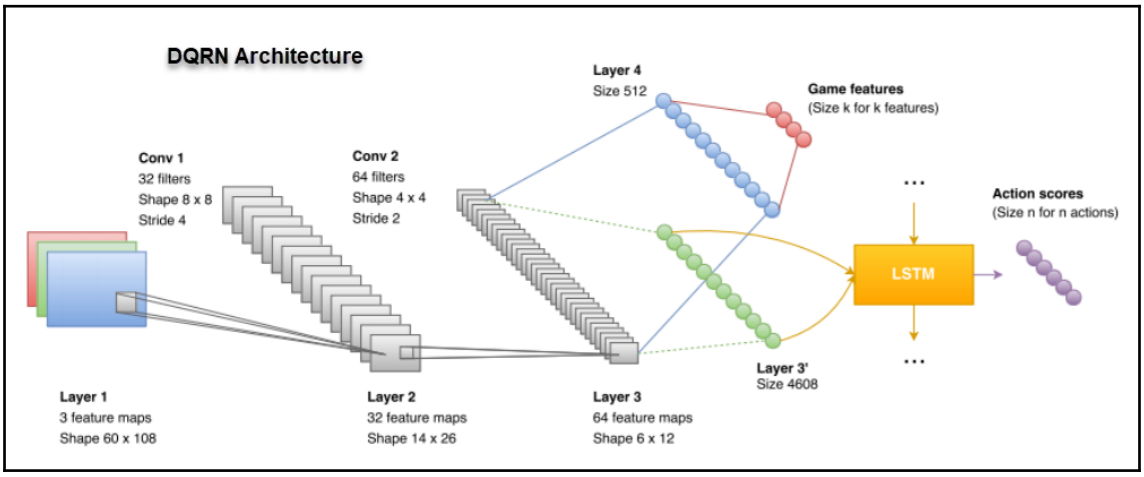
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 496000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 497000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 498000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 499000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.envs:Saved Model
NFO:mlagents.trainers: visualhallway2-0: VisualHallwayLearning: Step: 500000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
NFO:mlagents.envs:Saved Model
NFO:mlagents.trainers:List of nodes to export for brain :VisualHallwayLearning
NFO:mlagents.trainers: is_continuous_control
NFO:mlagents.trainers: version_number
NFO:mlagents.trainers: memory_size
NFO:mlagents.trainers: action_output_shape
NFO:mlagents.trainers: recurrent_out
NFO:mlagents.trainers: action_probs
NFO:mlagents.trainers: action
NFO:mlagents.trainers: value_estimate
NFO:tensorflow:Restoring parameters from ./models/visualhallway2-0/VisualHallwayLearning\model-500001.cptk
NFO:tensorflow:Froze 15 variables.
onverted 15 variables to const ops.


Inspector
Static
Tag
Untagged
Layer
Default
Multiple
Open
Select
Overrides
Transform
Position
Rotation
Scale
X
Y
Z
0
1

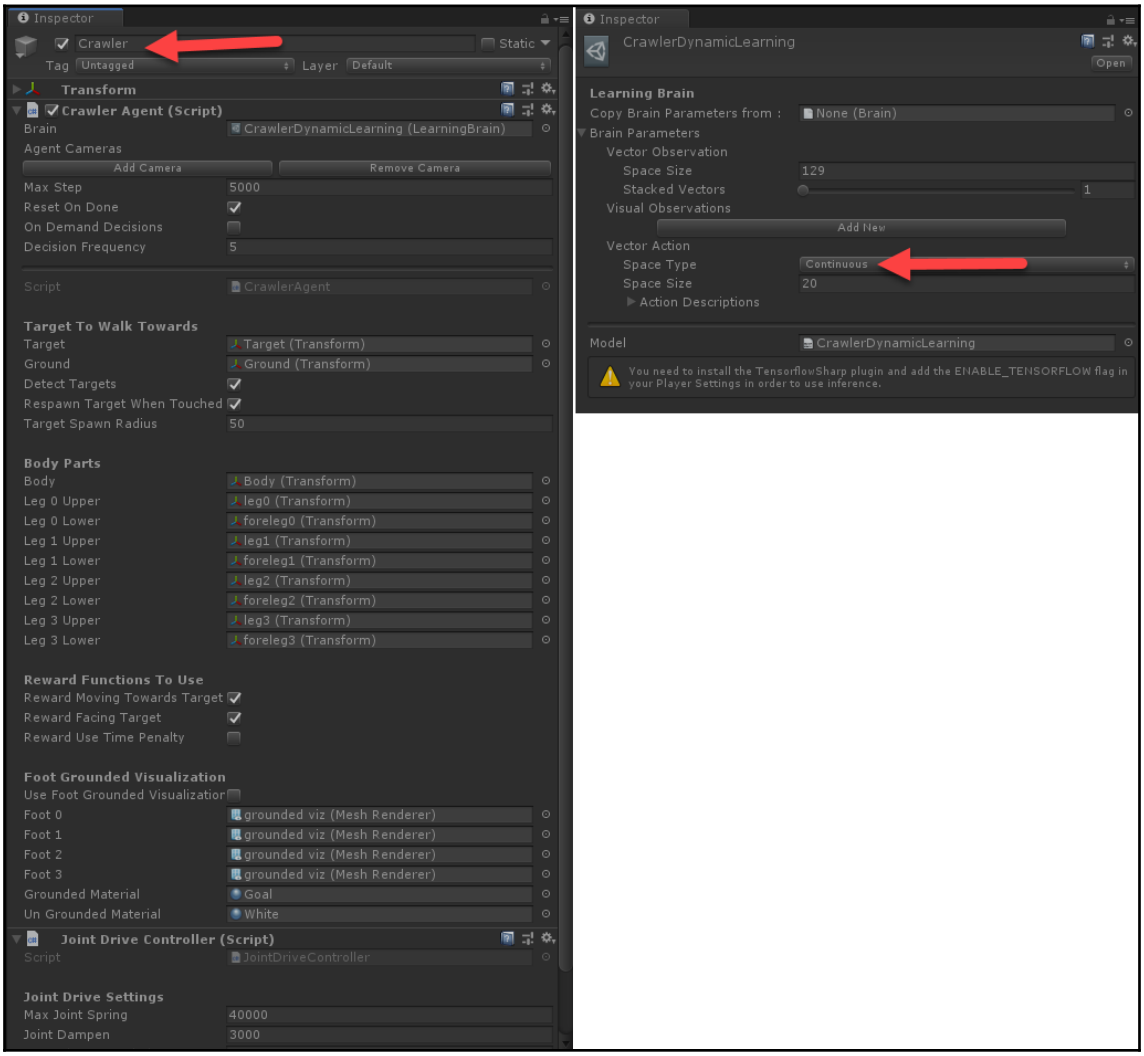

Hallway Agent (Script)
Brain
Agent Cameras
Add Camera
Max Step
3000
Reset On Done
On Demand Decisions
Decision Frequency
6
Script
Ground
Area
Orange Goal
Red Goal
redGoal
Orange Block
orangeBlock
Red Block
redBlock
Use Vector Obs
Ray Perception (Script)
Script
RayPerception
Reset
Remove Component
Move Up
Move Down
Copy Component
Paste Component As New
Paste Component Values
Find References In Scene
Edit Script

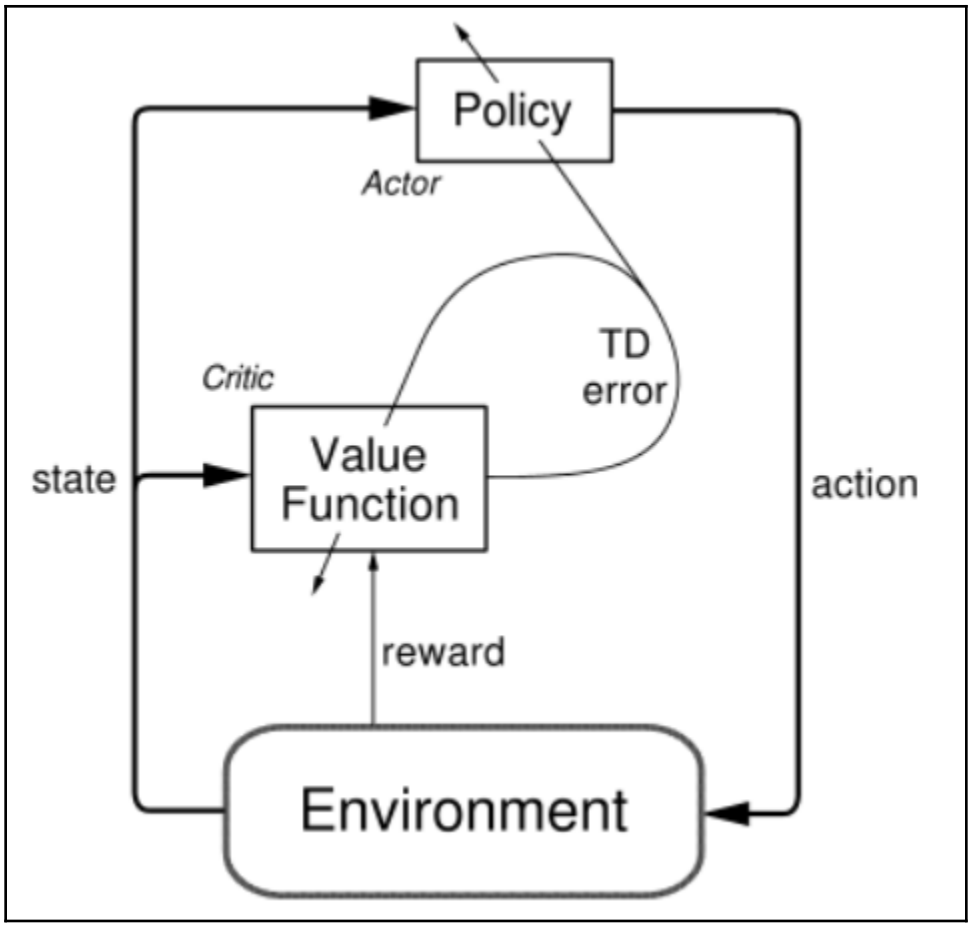

Inspector
HallwayLearning
Open
Learning Brain
Copy Brain Parameters from
None (Brain)
Brain Parameters
Vector Observation
Space Size
15
Stacked Vectors
3
Visual Observations
Add New
Vector Action
Space Type
Discrete
Branches Size
1
Branch 0 Size
5
Branch Descriptions

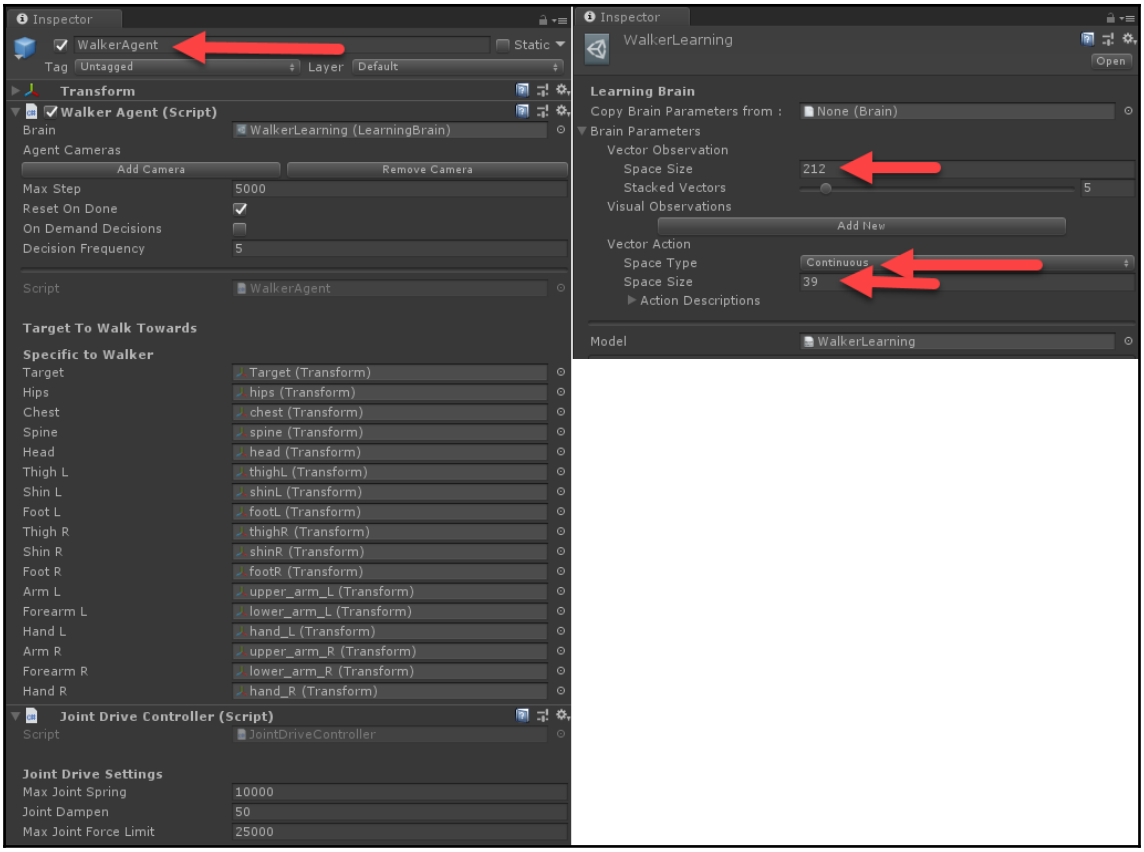

Inspector
VisualHallwayLearning
Open
Learning Brain
Copy Brain Parameters from
None (Brain)
Brain Parameters
Vector Observation
Space Size
0
Stacked Vectors
1
Visual Observations
Add New
Remove Last
Index
Width
Height
Gray
Obs 0
32
32
Vector Action
Space Type
Discrete
Branches Size
1
Branch 0 Size
1
Branch Descriptions

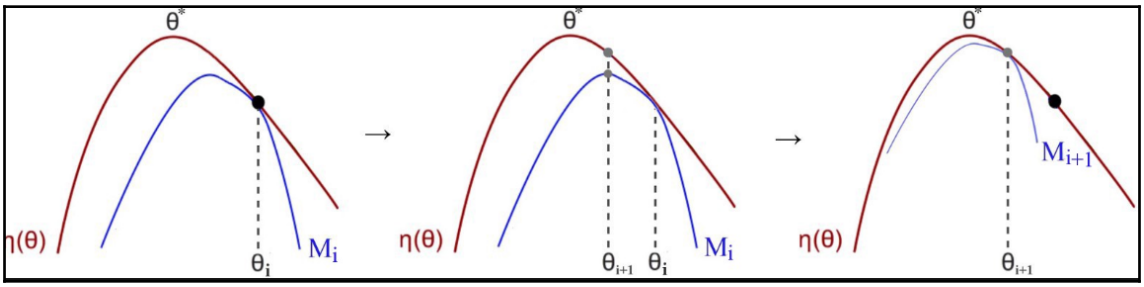

DQRN Architecture
Layer 4
Size 512
Game features
(Size k for k features)
Conv 1
32 filters
Shape 8 x 8
Stride 4
Conv 2
64 filters
Shape 4 x 4
Stride 2
Action scores
(Size n for n actions)
LSTM
Layer 3'
Size 4608
Layer 1
3 feature maps
Shape 60 x 108
Layer 2
32 feature maps
Shape 14 x 26
Layer 3
64 feature maps
Shape 6 x 12

Chapter 8: Understanding PPO




Policy
Actor
TD
error
Critic
Value
Function
state
action
reward
Environment


Inspector
WalkerAgent
Static
Tag Untagged
Layer Default
Transform
Walker Agent (Script)
Brain
WalkerLearning (LearningBrain)
Agent Cameras
Add Camera
Remove Camera
Max Step
5000
Reset On Done
On Demand Decisions
Decision Frequency
5
Script
WalkerAgent
Target To Walk Towards
Specific to Walker
Target
Target (Transform)
Hips
hips (Transform)
Chest
chest (Transform)
Spine
spine (Transform)
Head
head (Transform)
Thigh L
thighL (Transform)
Shin L
shinL (Transform)
Foot L
footL (Transform)
Thigh R
thighR (Transform)
Shin R
shinR (Transform)
Foot R
footR (Transform)
Arm L
upper_arm_L (Transform)
Forearm L
lower_arm_L (Transform)
Hand L
hand_L (Transform)
Arm R
upper_arm_R (Transform)
Forearm R
lower_arm_R (Transform)
Hand R
hand_R (Transform)
Joint Drive Controller (Script)
Script
JointDriveController
Joint Drive Settings
Max Joint Spring
10000
Joint Dampen
50
Max Joint Force Limit
25000
Inspector
WalkerLearning
Open
Learning Brain
Copy Brain Parameters from :
None (Brain)
Brain Parameters
Vector Observation
Space Size
212
Stacked Vectors
5
Visual Observations
Add New
Vector Action
Space Type
Continuous
Space Size
39
Action Descriptions
Model
WalkerLearning


θ*
η(θ)
θi
Mi
θ*
η(θ)
θi+1
θi
Mi
θ*
η(θ)
θi+1
Mi+1

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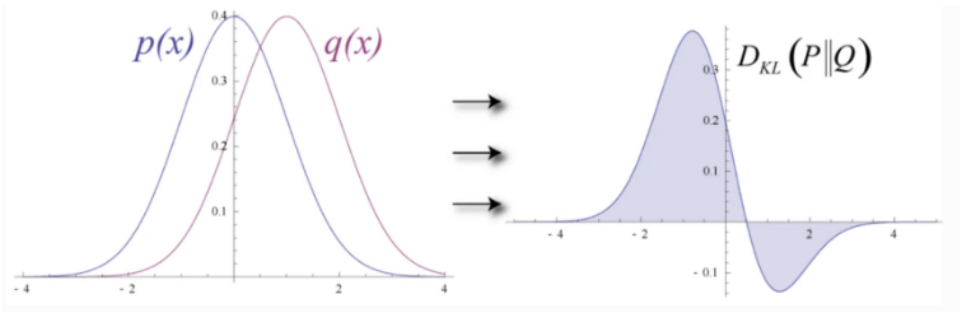
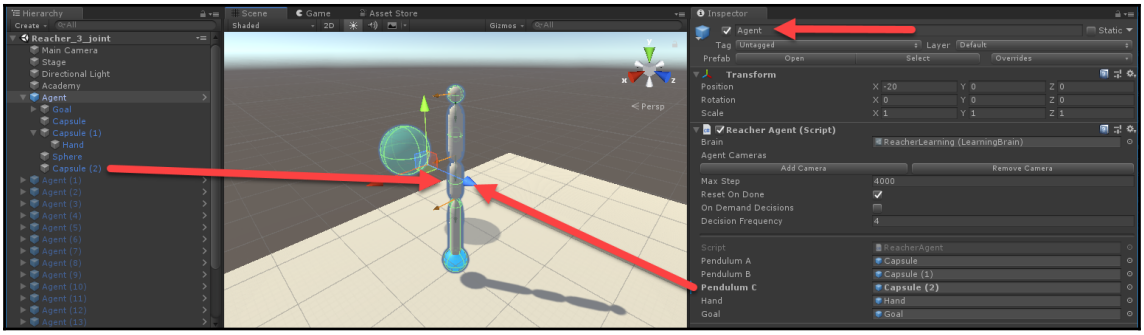
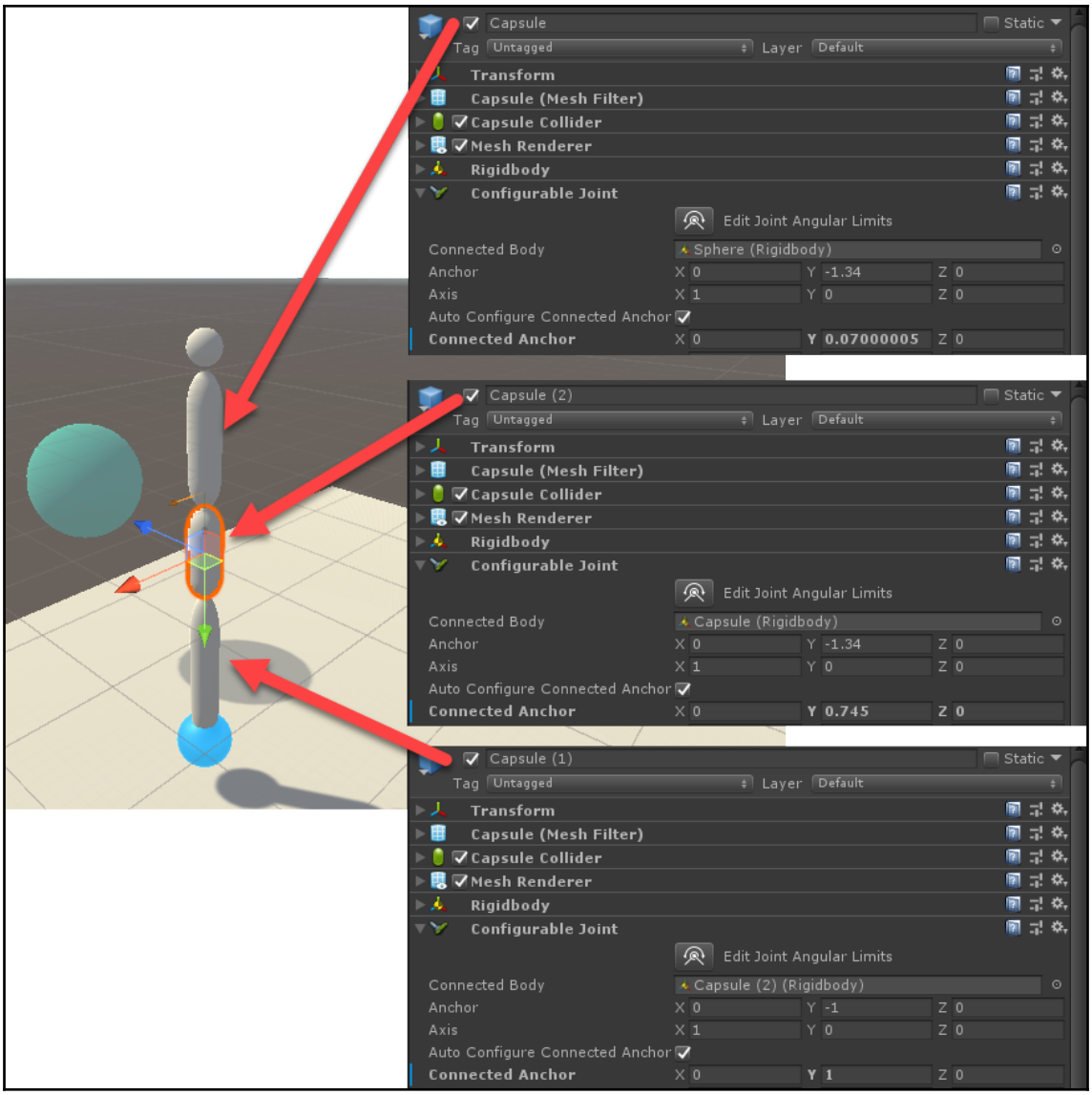
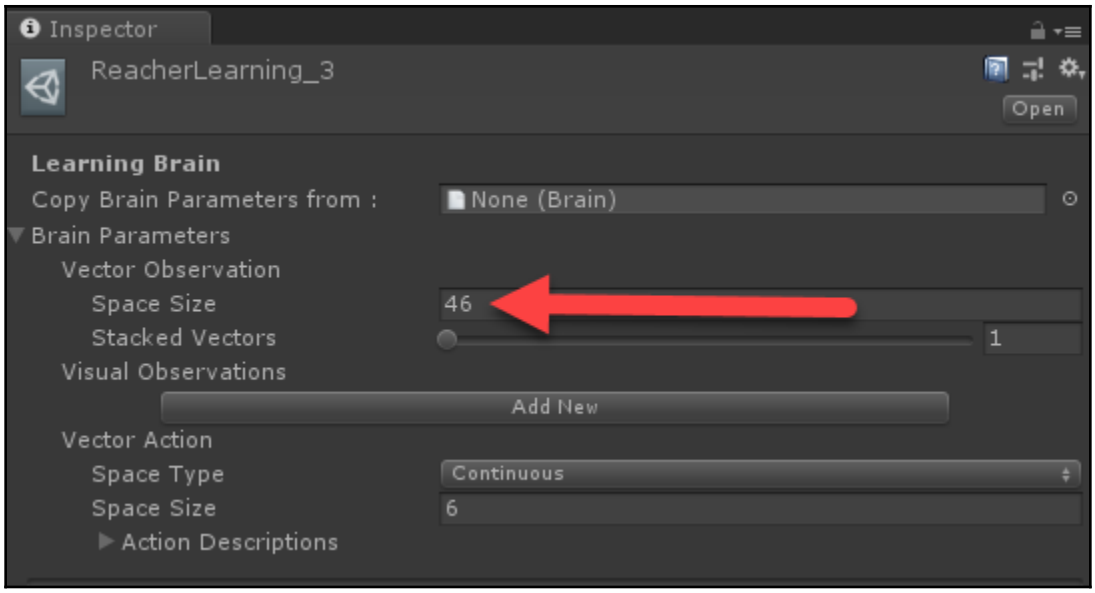


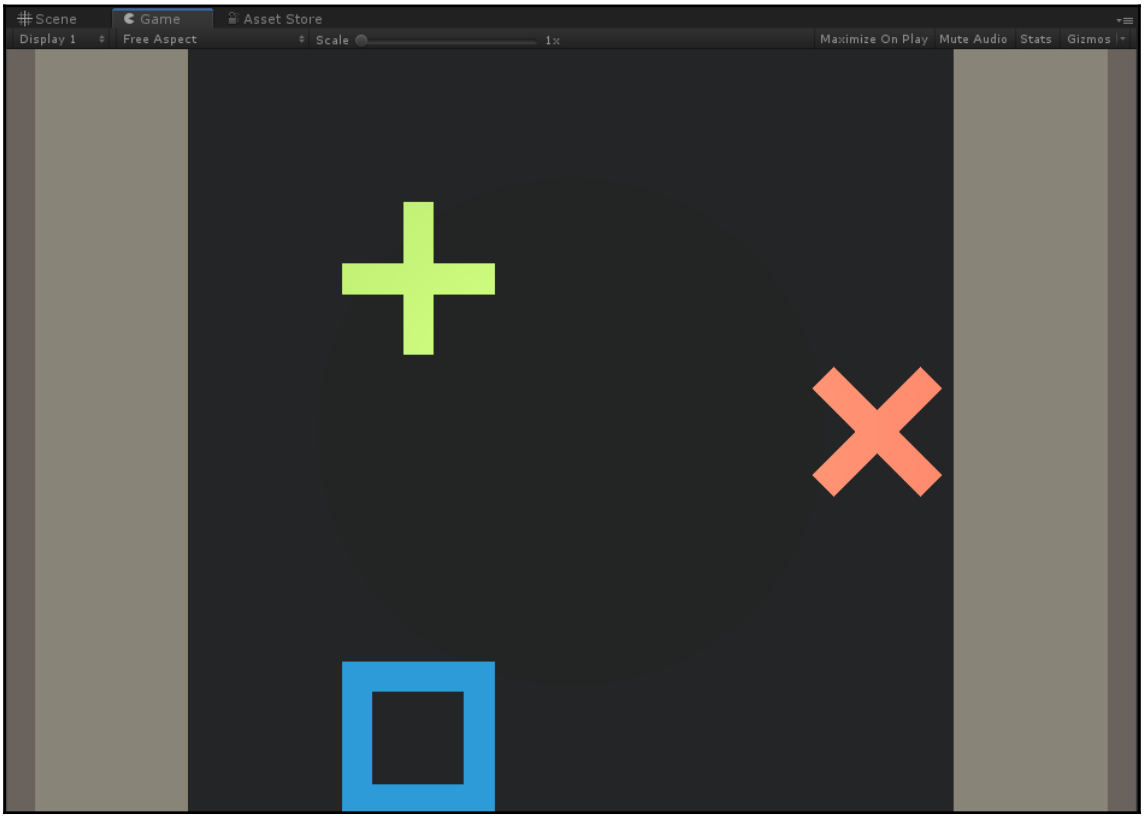
Source: Wikipedia

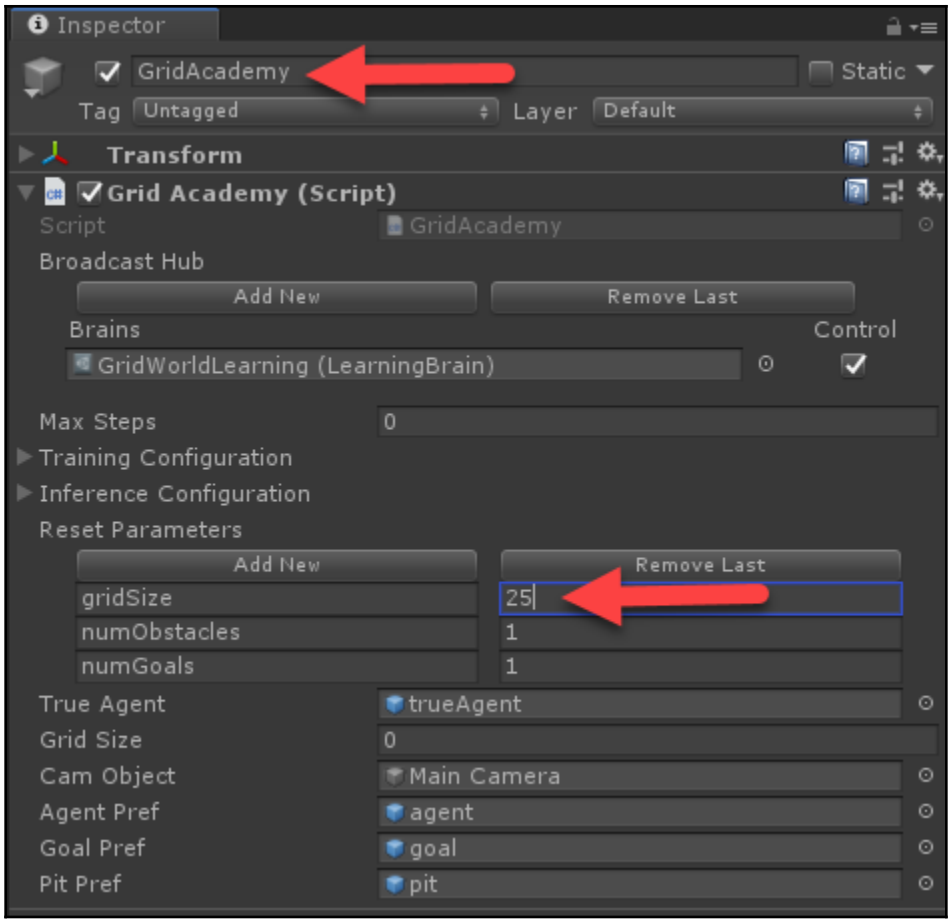

Hierarchy
Create
Reacher_3_joint
Main Camera
Stage
Directional Light
Academy
Agent
Goal
Capsule
Capsule (1)
Hand
Sphere
Capsule (2)
Scene
Game
Asset Store
Shaded
2D
Gizmos
Persp
Inspector
Agent
Static
Tag
Untagged
Layer
Default
Prefab
Open
Select
Overrides
Transform
Position
Rotation
Scale
Reacher Agent (Script)
Brain
ReacherLearning (LearningBrain)
Agent Cameras
Add Camera
Remove Camera
Max Step
4000
Reset On Done
On Demand Decisions
Decision Frequency
4
Script
ReacherAgent
Pendulum A
Capsule
Pendulum B
Capsule (1)
Pendulum C
Capsule (2)
Hand
Hand
Goal
Goal

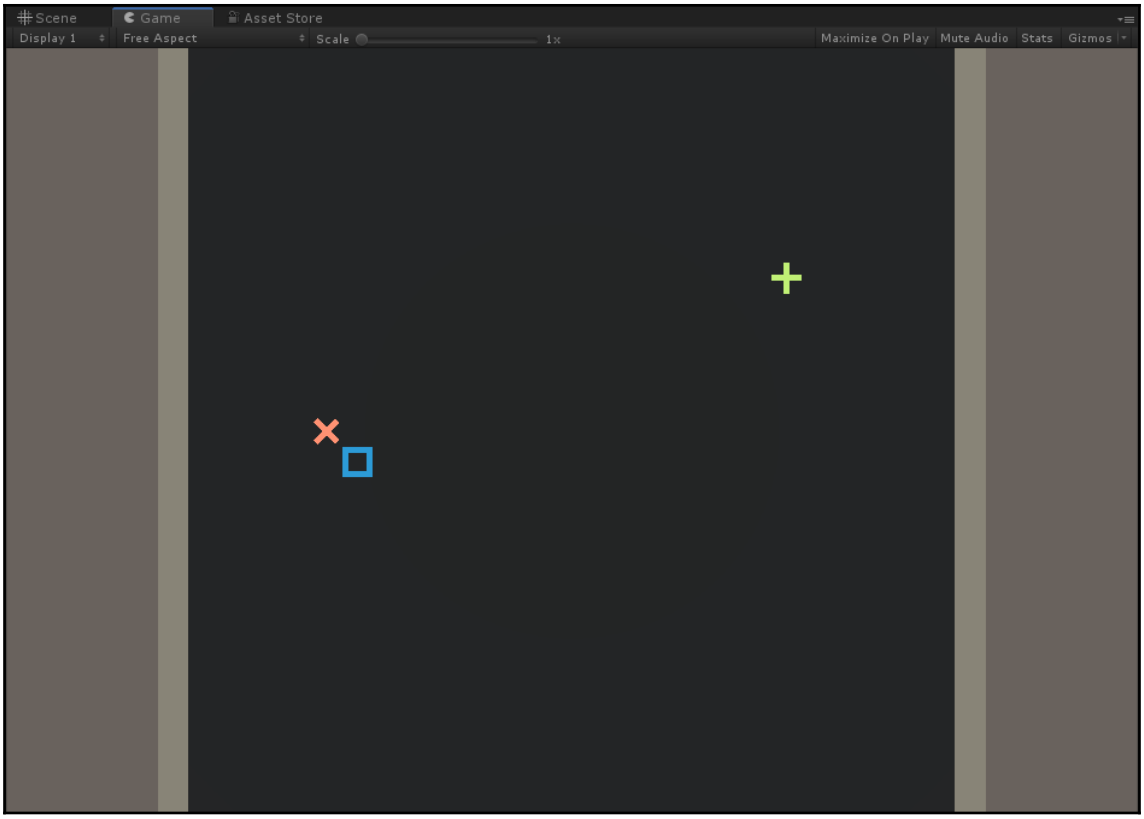

Capsule
Static
Tag Untagged
Layer Default
Transform
Capsule (Mesh Filter)
Capsule Collider
Mesh Renderer
Rigidbody
Configurable Joint
Edit Joint Angular Limits
Connected Body
Sphere (Rigidbody)
Anchor
X 0 Y -1.34 Z 0
Axis
X 1 Y 0 Z 0
Auto Configure Connected Anchor
Connected Anchor
X 0 Y 0.07000005 Z 0
Capsule (2)
Static
Tag Untagged
Layer Default
Transform
Capsule (Mesh Filter)
Capsule Collider
Mesh Renderer
Rigidbody
Configurable Joint
Edit Joint Angular Limits
Connected Body
Capsule (Rigidbody)
Anchor
X 0 Y -1.34 Z 0
Axis
X 1 Y 0 Z 0
Auto Configure Connected Anchor
Connected Anchor
X 0 Y 0.745 Z 0
Capsule (1)
Static
Tag Untagged
Layer Default
Transform
Capsule (Mesh Filter)
Capsule Collider
Mesh Renderer
Rigidbody
Configurable Joint
Edit Joint Angular Limits
Connected Body
Capsule (2) (Rigidbody)
Anchor
X 0 Y -1 Z 0
Axis
X 1 Y 0 Z 0
Auto Configure Connected Anchor
Connected Anchor
X 0 Y 1 Z 0

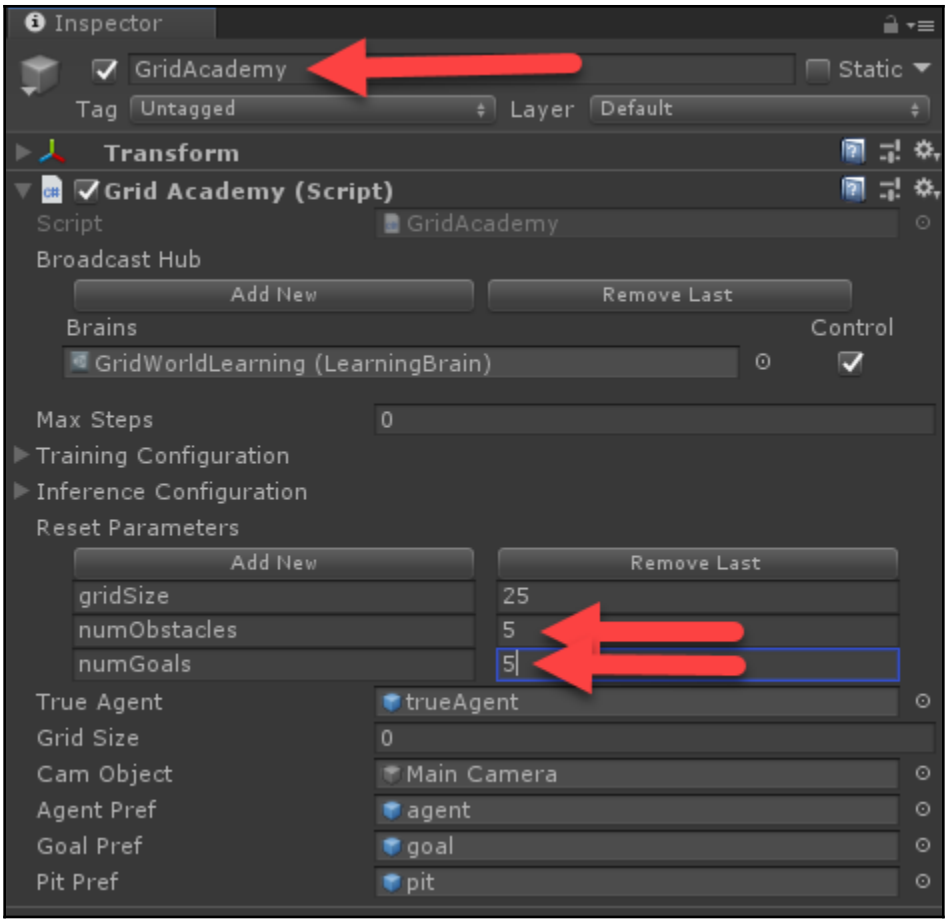

Inspector
ReacherLearning_3
Open
Learning Brain
Copy Brain Parameters from :
None (Brain)
Brain Parameters
Vector Observation
Space Size
46
Stacked Vectors
1
Visual Observations
Add New
Vector Action
Space Type
Continuous
Space Size
6
Action Descriptions

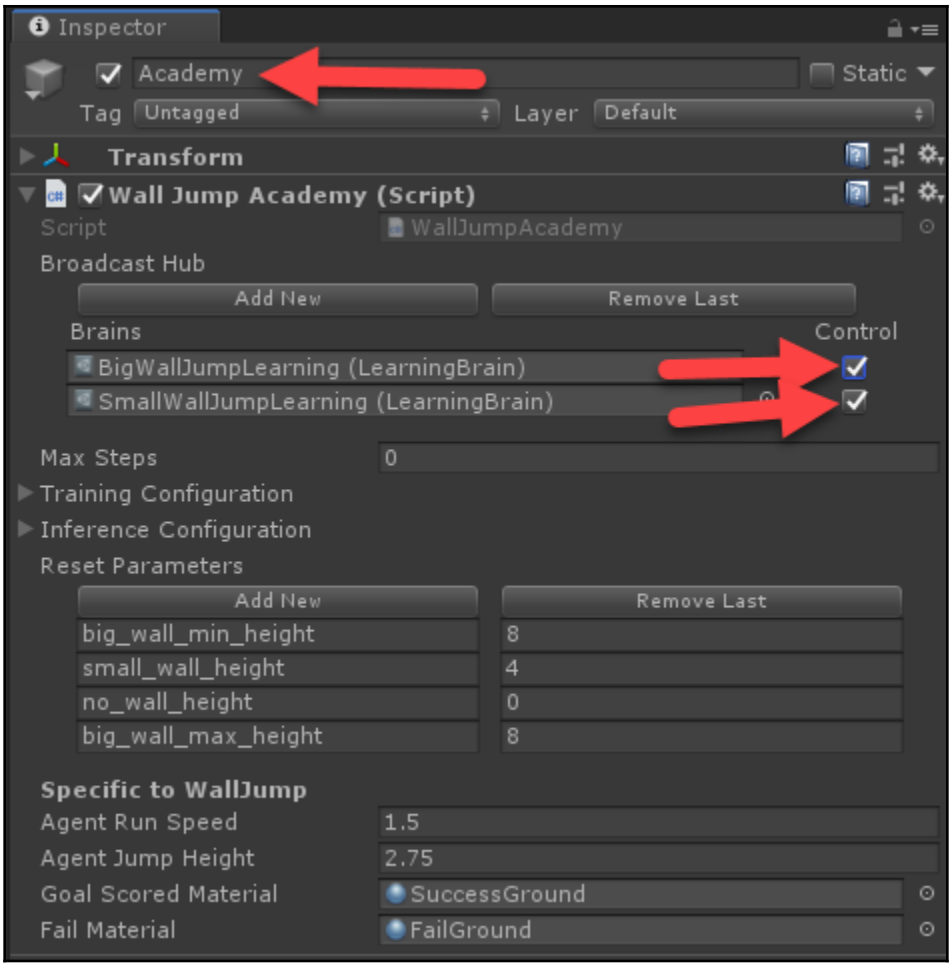
Chapter 9: Rewards and Reinforcement Learning

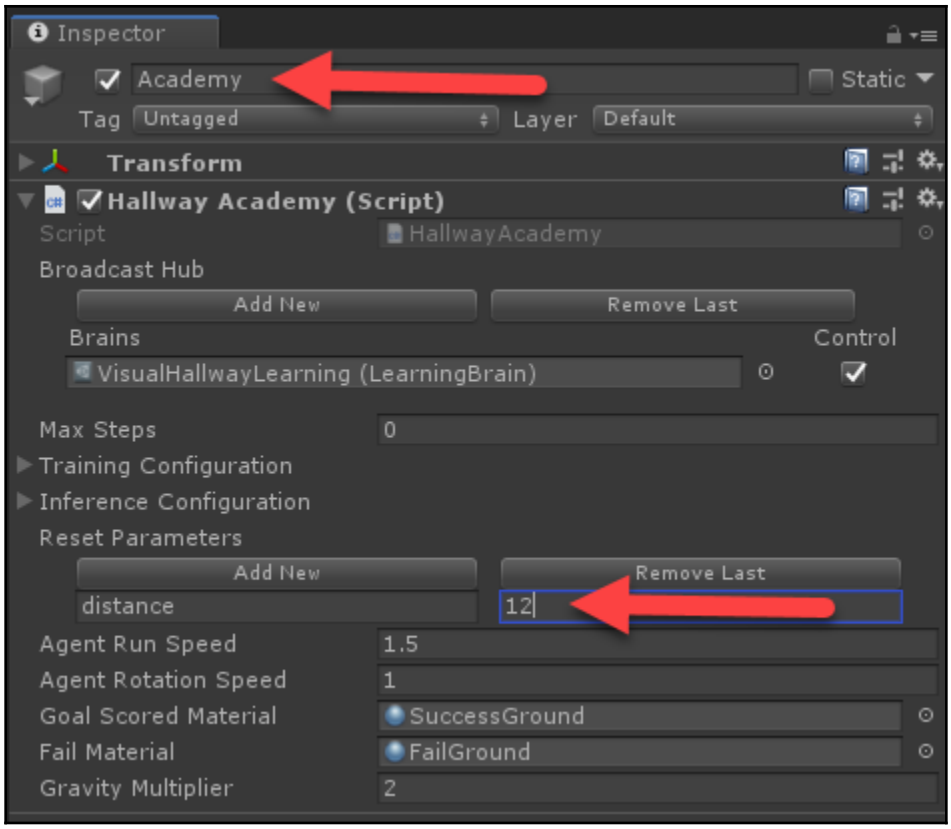


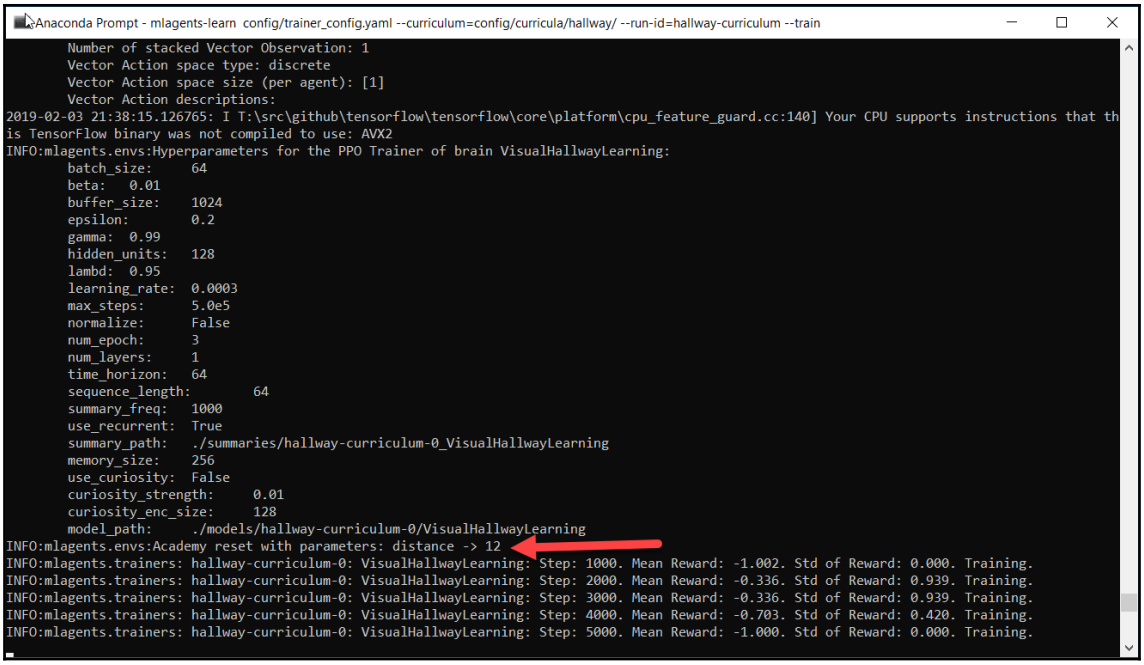

Inspector
GridAcademy
Static
Tag
Untagged
Layer
Default
Transform
Grid Academy (Script)
Script
GridAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
GridWorldLearning (LearningBrain)
Max Steps
0
Training Configuration
Inference Configuration
Reset Parameters
Add New
Remove Last
gridSize
25
numObstacles
1
numGoals
1
True Agent
trueAgent
Grid Size
0
Cam Object
Main Camera
Agent Pref
agent
Goal Pref
goal
Pit Pref
pit

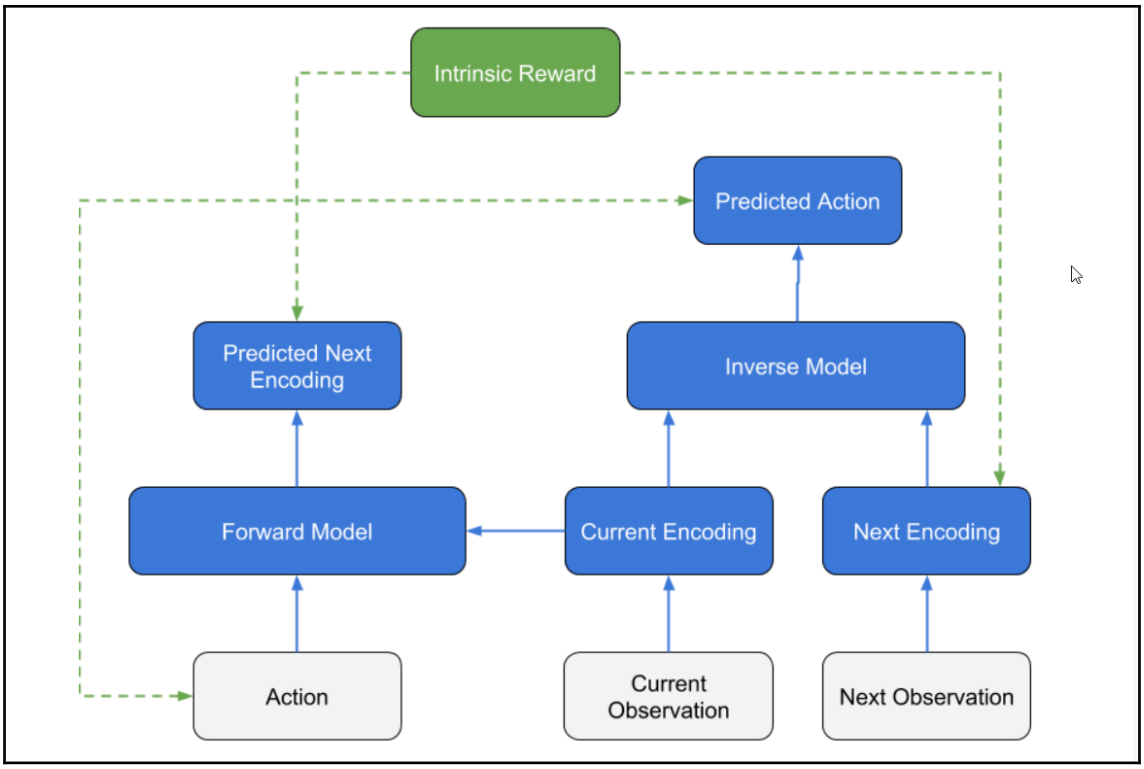

Scene
Game
Asset Store
Display 1
Free Aspect
Scale
1x
Maximize On Play
Mute Audio
Stats
Gizmos

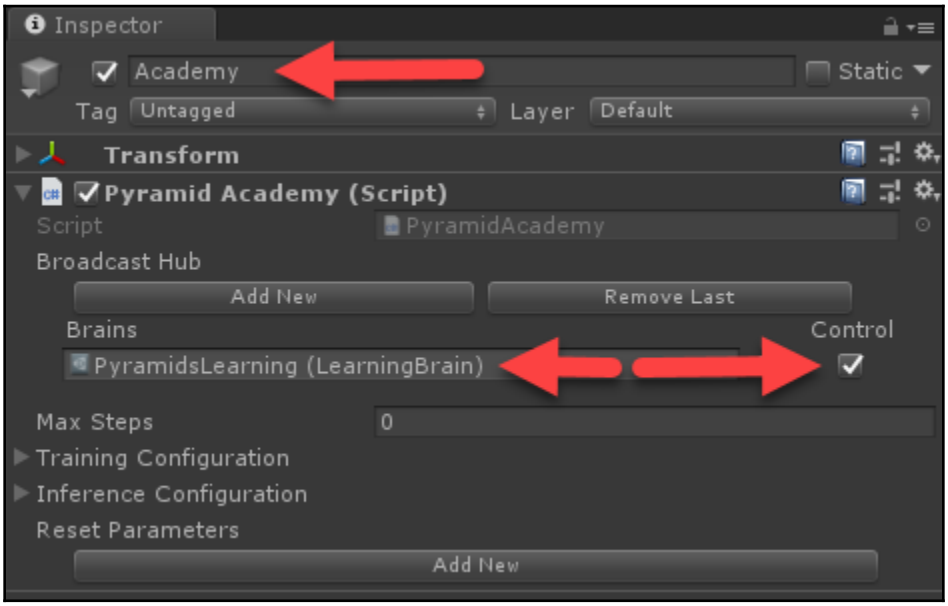

Inspector
GridAcademy
Static
Tag
Untagged
Layer
Default
Transform
Grid Academy (Script)
Script
GridAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
GridWorldLearning (LearningBrain)
Max Steps
0
Training Configuration
Inference Configuration
Reset Parameters
Add New
Remove Last
gridSize
25
numObstacles
5
numGoals
5
True Agent
trueAgent
Grid Size
0
Cam Object
Main Camera
Agent Pref
agent
Goal Pref
goal
Pit Pref
pit


Inspector
Academy
Static
Tag
Untagged
Layer
Default
Transform
Wall Jump Academy (Script)
Script
WallJumpAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
BigWallJumpLearning (LearningBrain)
SmallWallJumpLearning (LearningBrain)
Max Steps
0
Training Configuration
Inference Configuration
Reset Parameters
Add New
Remove Last
big_wall_min_height
8
small_wall_height
4
no_wall_height
0
big_wall_max_height
8
Specific to WallJump
Agent Run Speed
1.5
Agent Jump Height
2.75
Goal Scored Material
SuccessGround
Fail Material
FailGround

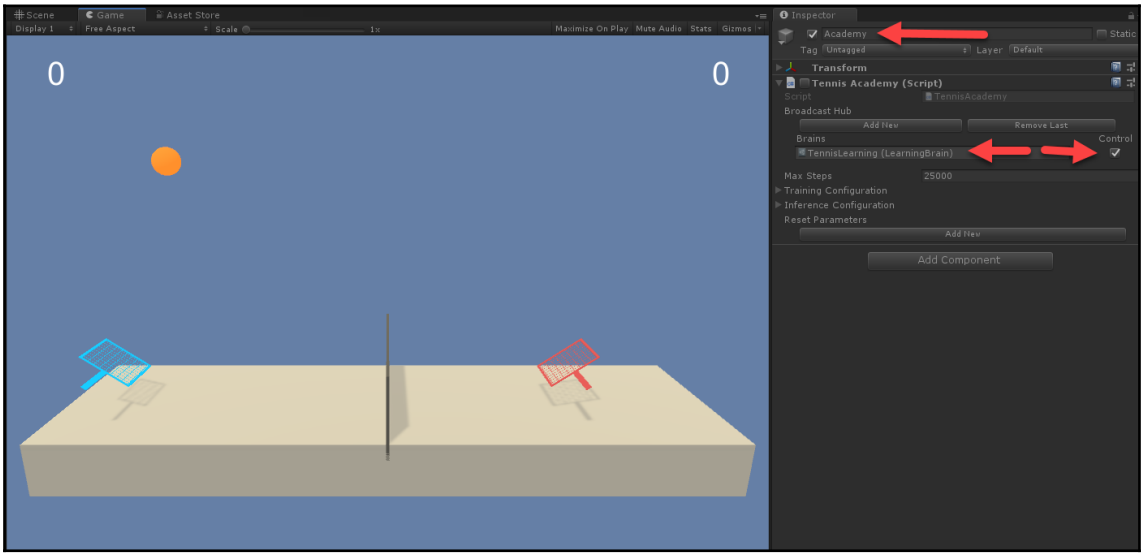

Inspector
Academy
Static
Tag
Untagged
Layer
Default
Transform
Hallway Academy (Script)
Script
HallwayAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
VisualHallwayLearning (LearningBrain)
Max Steps
0
Training Configuration
Inference Configuration
Reset Parameters
Add New
Remove Last
distance
12
Agent Run Speed
1.5
Agent Rotation Speed
1
Goal Scored Material
SuccessGround
Fail Material
FailGround
Gravity Multiplier
2

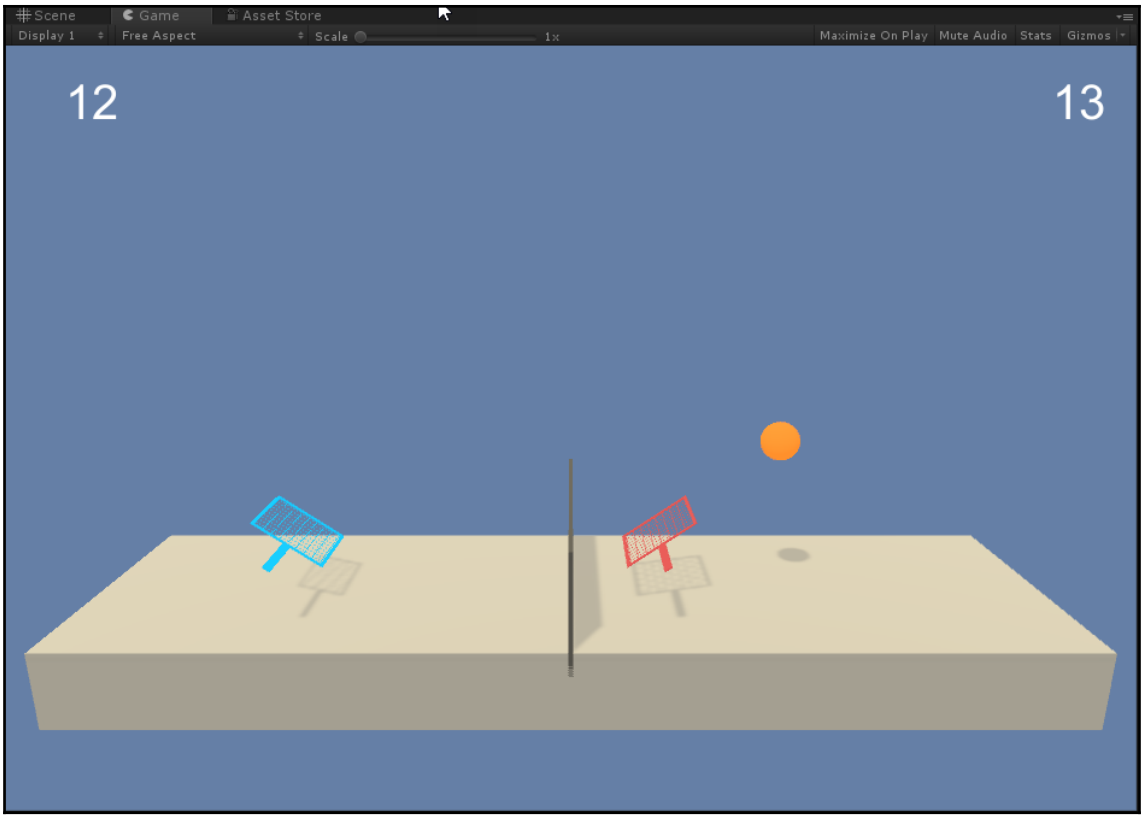

Anaconda Prompt - mlagents-learn config/trainer_config.yaml --curriculum=config/curricula/hallway/ --run-id=hallway-curriculum --train
Number of stacked Vector Observation: 1
Vector Action space type: discrete
Vector Action space size (per agent): [1]
Vector Action descriptions:
2019-02-03 21:38:15.126765: I T:\src\github\tensorflow\tensorflow\core\platform\cpu_feature_guard.cc:140] Your CPU supports instructions that th
is TensorFlow binary was not compiled to use: AVX2
INFO:mlagents.envs:Hyperparameters for the PPO Trainer of brain VisualHallwayLearning:
batch_size: 64
beta: 0.01
buffer_size: 1024
epsilon: 0.2
gamma: 0.99
hidden_units: 128
lambd: 0.95
learning_rate: 0.0003
max_steps: 5.0e5
normalize: False
num_epoch: 3
num_layers: 1
time_horizon: 64
sequence_length: 64
summary_freq: 1000
use_recurrent: True
summary_path: ./summaries/hallway-curriculum-0_VisualHallwayLearning
memory_size: 256
use_curiosity: False
curiosity_strength: 0.01
curiosity_enc_size: 128
model_path: ./models/hallway-curriculum-0/VisualHallwayLearning
INFO:mlagents.envs:Academy reset with parameters: distance -> 12
INFO:mlagents.trainers: hallway-curriculum-0: VisualHallwayLearning: Step: 1000. Mean Reward: -1.002. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: hallway-curriculum-0: VisualHallwayLearning: Step: 2000. Mean Reward: -0.336. Std of Reward: 0.939. Training.
INFO:mlagents.trainers: hallway-curriculum-0: VisualHallwayLearning: Step: 3000. Mean Reward: -0.336. Std of Reward: 0.939. Training.
INFO:mlagents.trainers: hallway-curriculum-0: VisualHallwayLearning: Step: 4000. Mean Reward: -0.703. Std of Reward: 0.420. Training.
INFO:mlagents.trainers: hallway-curriculum-0: VisualHallwayLearning: Step: 5000. Mean Reward: -1.000. Std of Reward: 0.000. Training.

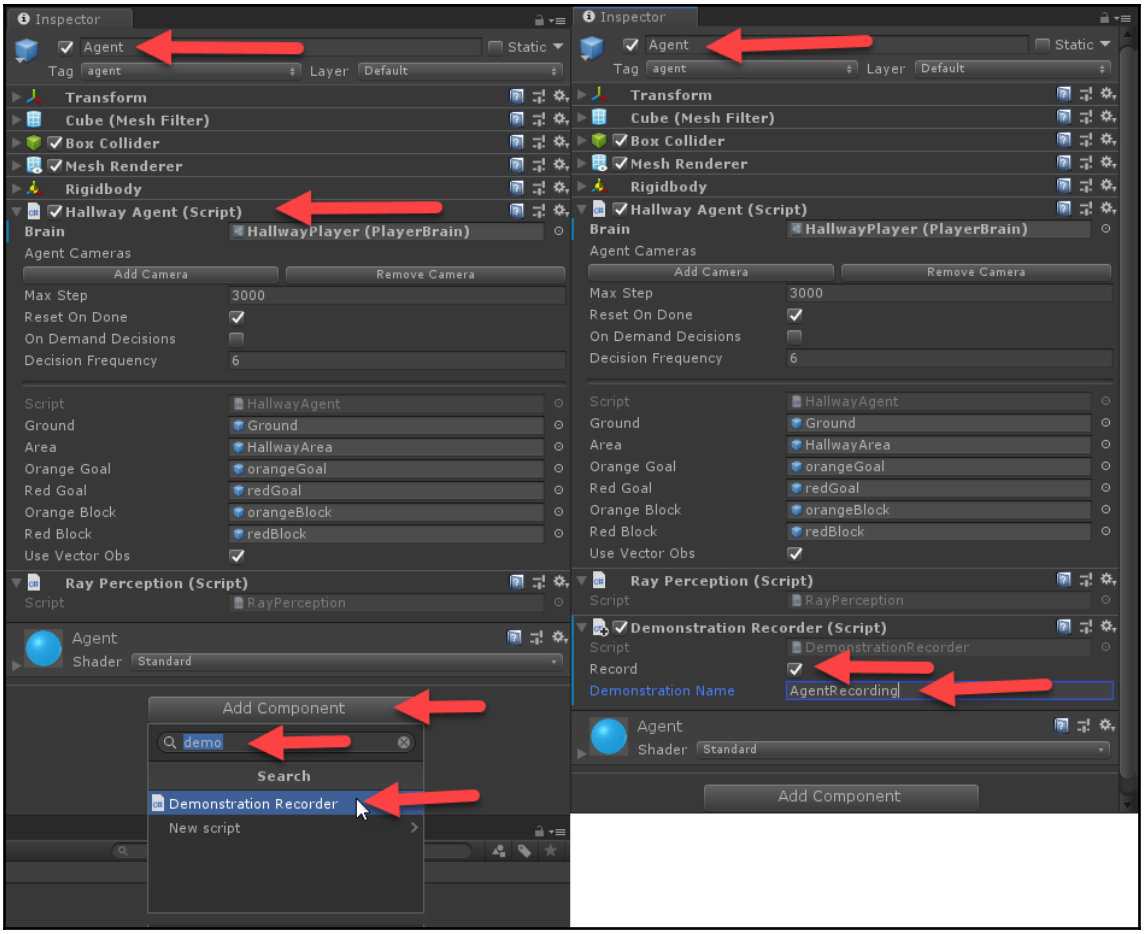

Intrinsic Reward
Predicted Action
Predicted Next Encoding
Inverse Model
Forward Model
Current Encoding
Next Encoding
Action
Current Observation
Next Observation

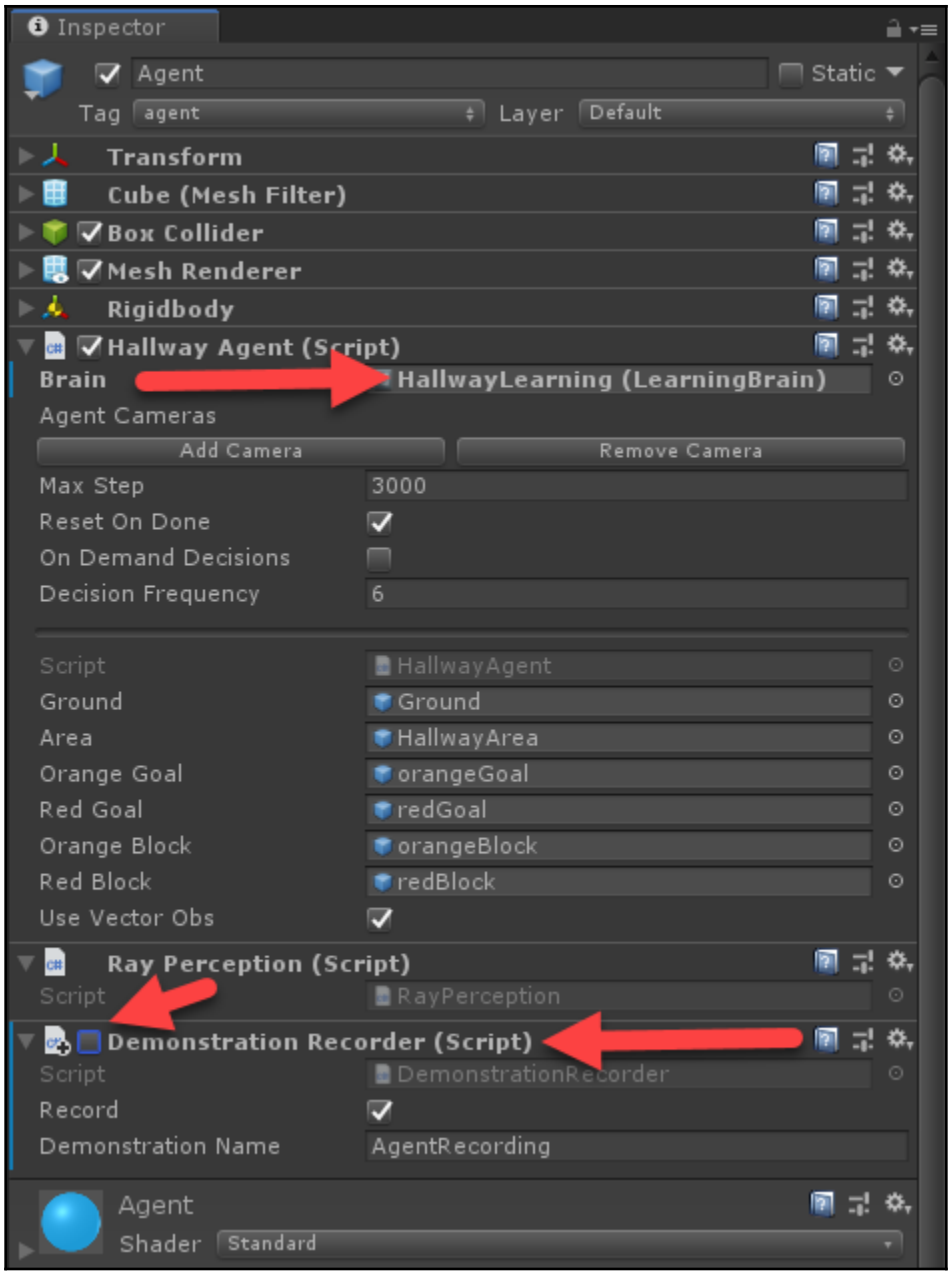

Inspector
Academy
Static
Tag
Untagged
Layer
Default
Transform
Pyramid Academy (Script)
Script
PyramidAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
PyramidsLearning (LearningBrain)
Max Steps
0
Training Configuration
Inference Configuration
Reset Parameters
Add New

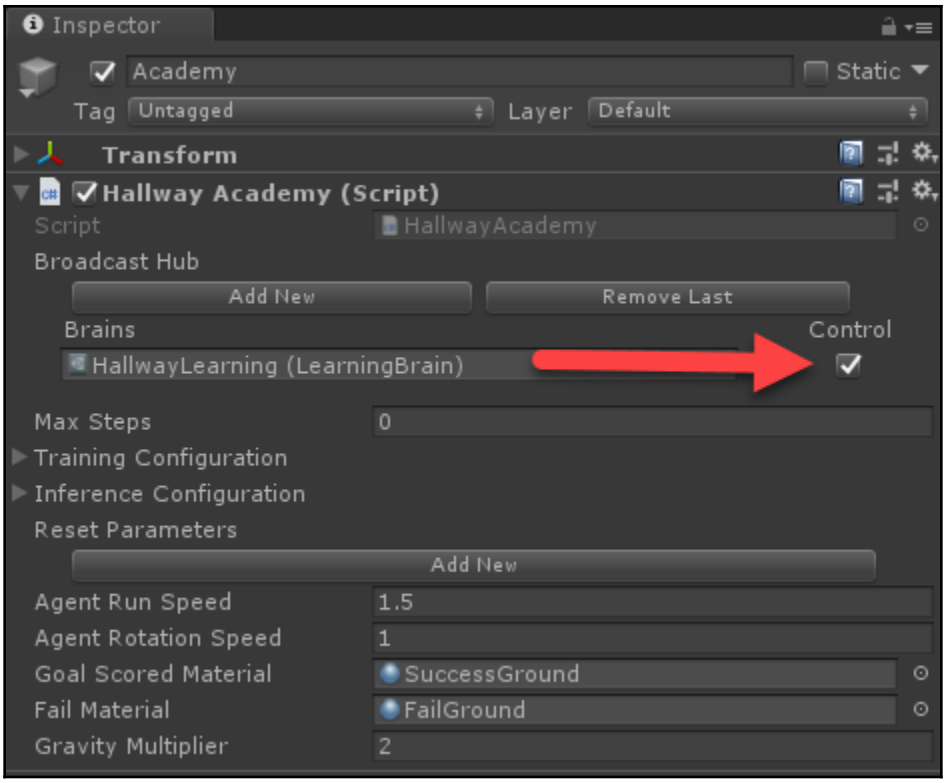
Chapter 10: Imitation and Transfer Learning

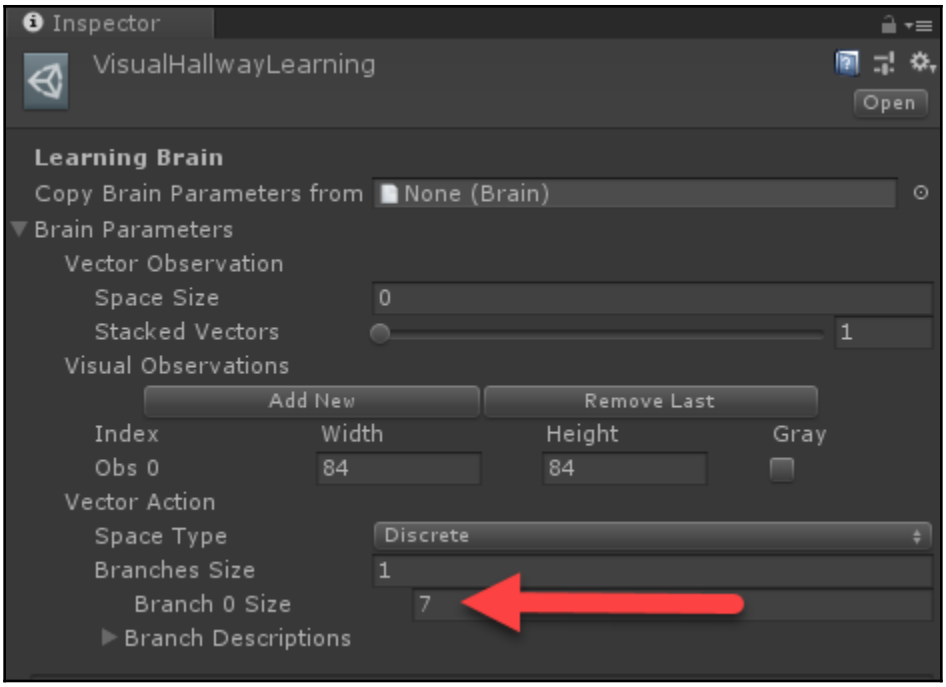


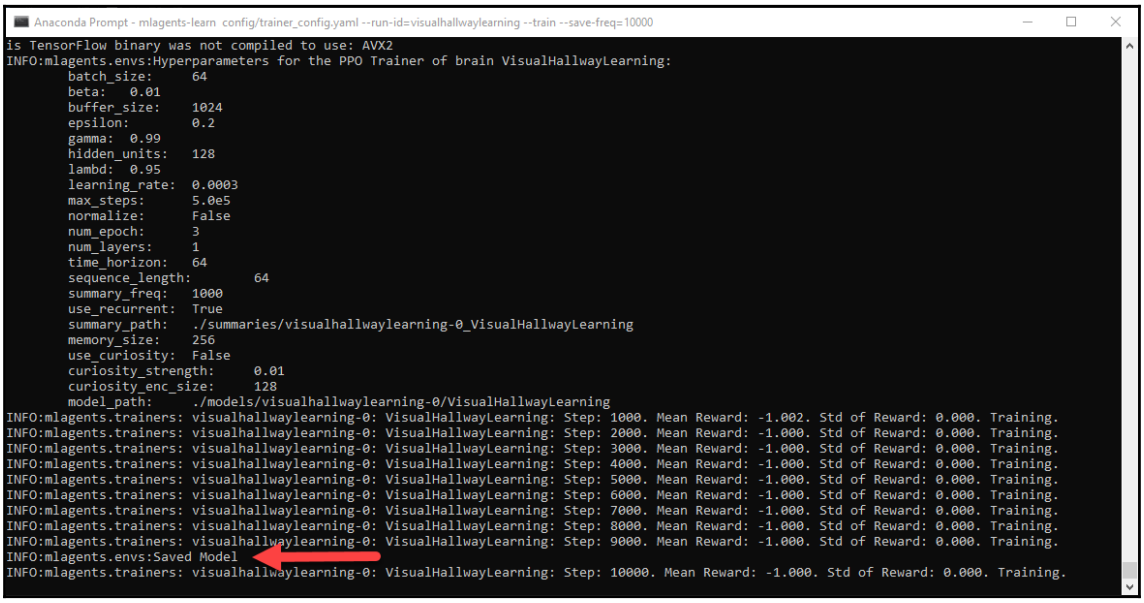

Scene
Game
Asset Store
Display 1
Free Aspect
Scale
1x
Maximize On Play
Mute Audio
Stats
Gizmos
12
13

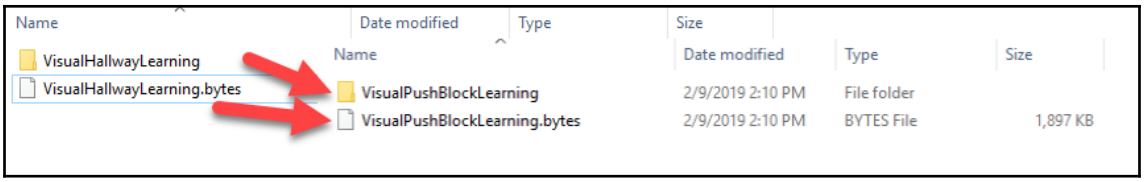

Inspector
Agent
Static
Tag agent
Layer Default
Transform
Cube (Mesh Filter)
Box Collider
Mesh Renderer
Rigidbody
Hallway Agent (Script)
Brain HallwayPlayer (PlayerBrain)
Agent Cameras
Add Camera
Remove Camera
Max Step 3000
Reset On Done
On Demand Decisions
Decision Frequency 6
Script HallwayAgent
Ground Ground
Area HallwayArea
Orange Goal orangeGoal
Red Goal redGoal
Orange Block orangeBlock
Red Block redBlock
Use Vector Obs
Ray Perception (Script)
Script RayPerception
Agent
Shader Standard
Add Component
demo
Search
Demonstration Recorder
New script
Demonstration Recorder (Script)
Script DemonstrationRecorder
Record
Demonstration Name AgentRecording

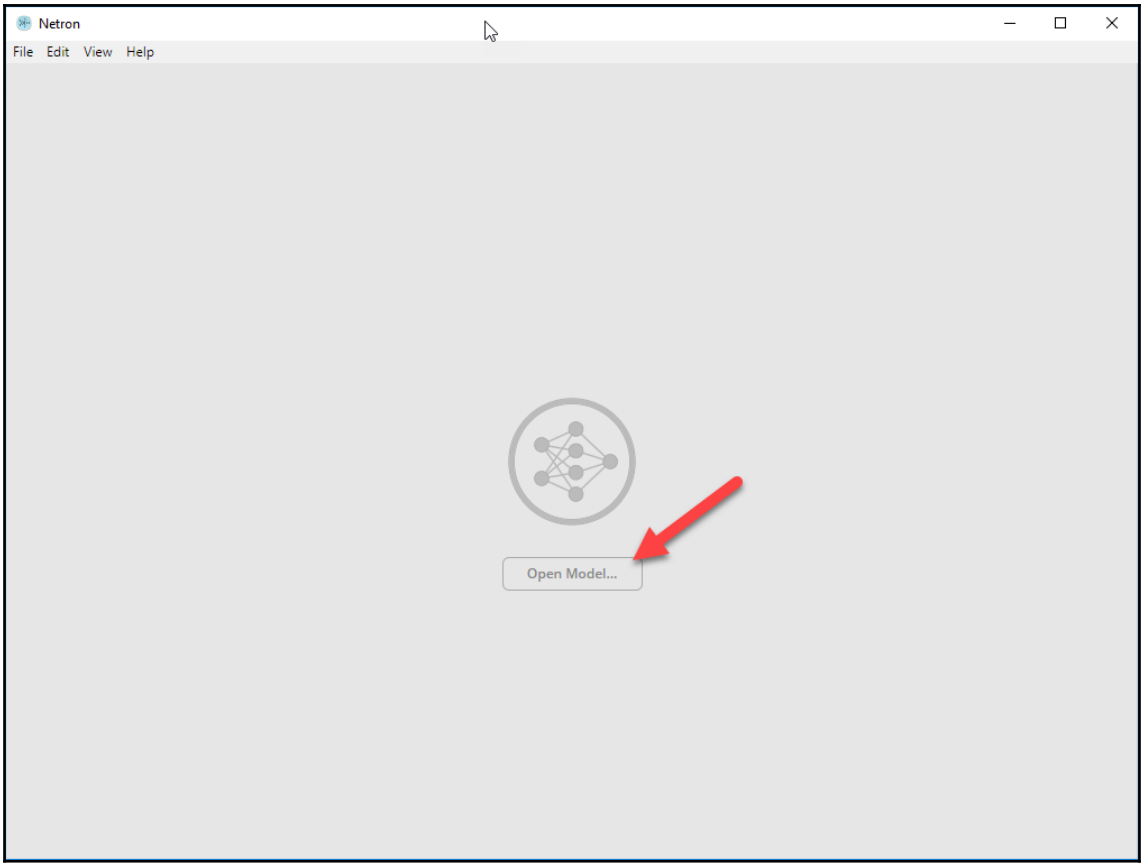

Inspector
Agent
Static
Tag agent
Layer Default
Transform
Cube (Mesh Filter)
Box Collider
Mesh Renderer
Rigidbody
Hallway Agent (Script)
Brain
HallwayLearning (LearningBrain)
Agent Cameras
Add Camera
Remove Camera
Max Step
3000
Reset On Done
On Demand Decisions
Decision Frequency
6
Script
HallwayAgent
Ground
Ground
Area
HallwayArea
Orange Goal
orangeGoal
Red Goal
redGoal
Orange Block
orangeBlock
Red Block
redBlock
Use Vector Obs
Ray Perception (Script)
Script
RayPerception
Demonstration Recorder (Script)
Script
DemonstrationRecorder
Record
Demonstration Name
AgentRecording
Agent
Shader
Standard

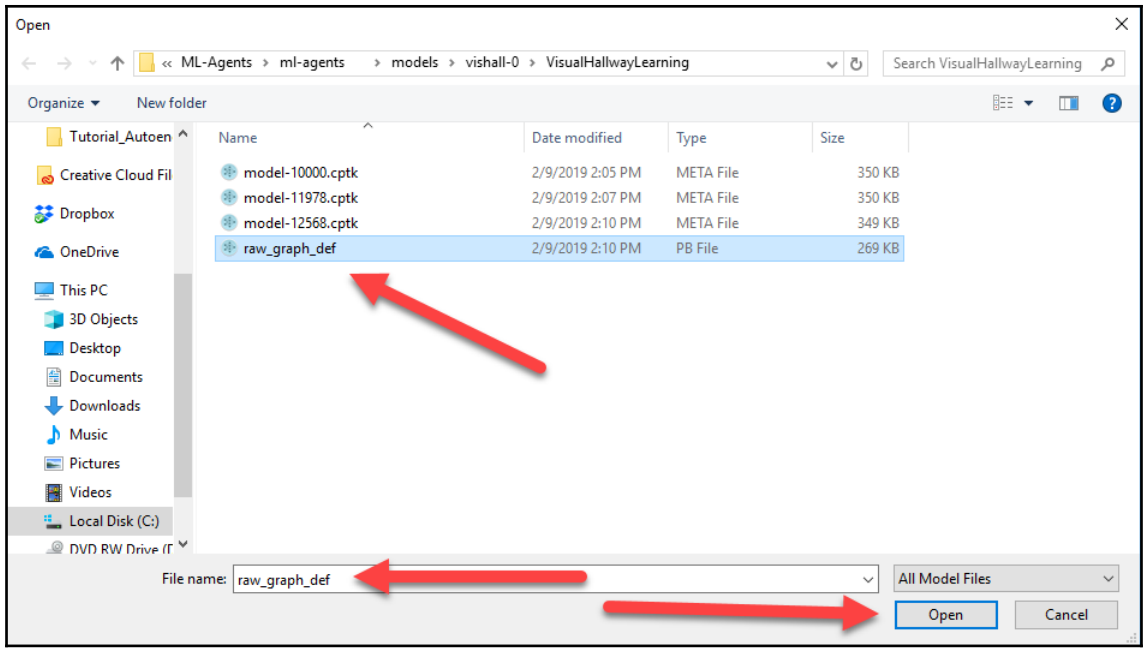

Inspector
Academy
Static
Tag
Untagged
Layer
Default
Transform
Hallway Academy (Script)
Script
HallwayAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
HallwayLearning (LearningBrain)
Max Steps
0
Training Configuration
Inference Configuration
Reset Parameters
Add New
Agent Run Speed
1.5
Agent Rotation Speed
1
Goal Scored Material
SuccessGround
Fail Material
FailGround
Gravity Multiplier
2

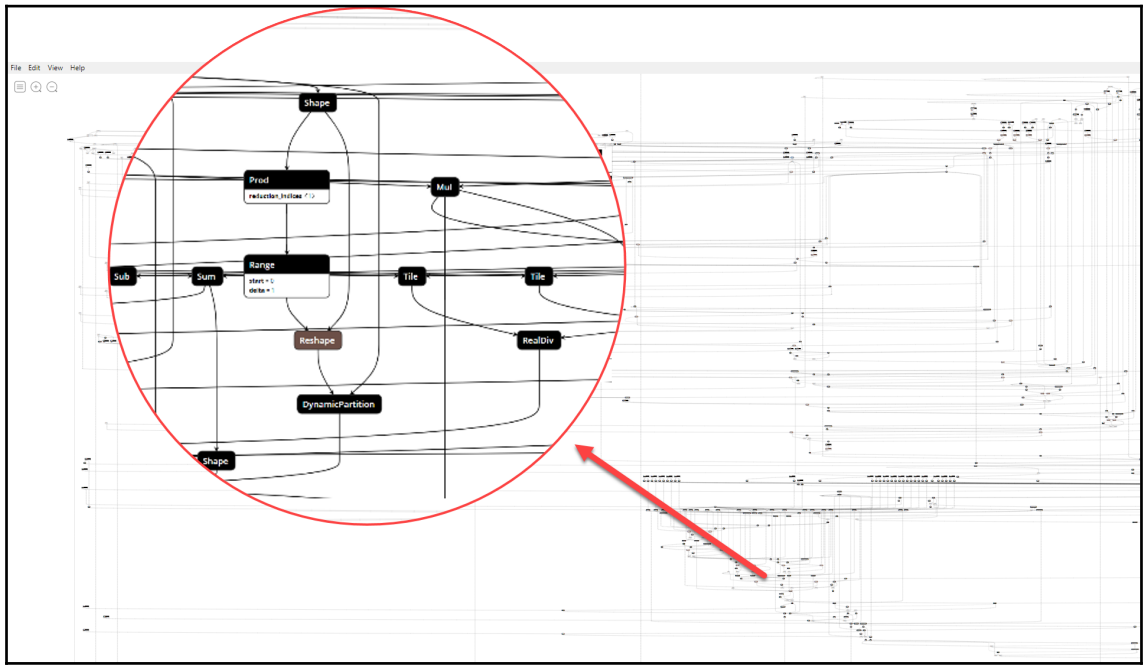

Inspector
VisualHallwayLearning
Open
Learning Brain
Copy Brain Parameters from
None (Brain)
Brain Parameters
Vector Observation
Space Size
0
Stacked Vectors
1
Visual Observations
Add New
Remove Last
Index
Width
Height
Gray
Obs 0
84
84
Vector Action
Space Type
Discrete
Branches Size
1
Branch 0 Size
7
Branch Descriptions

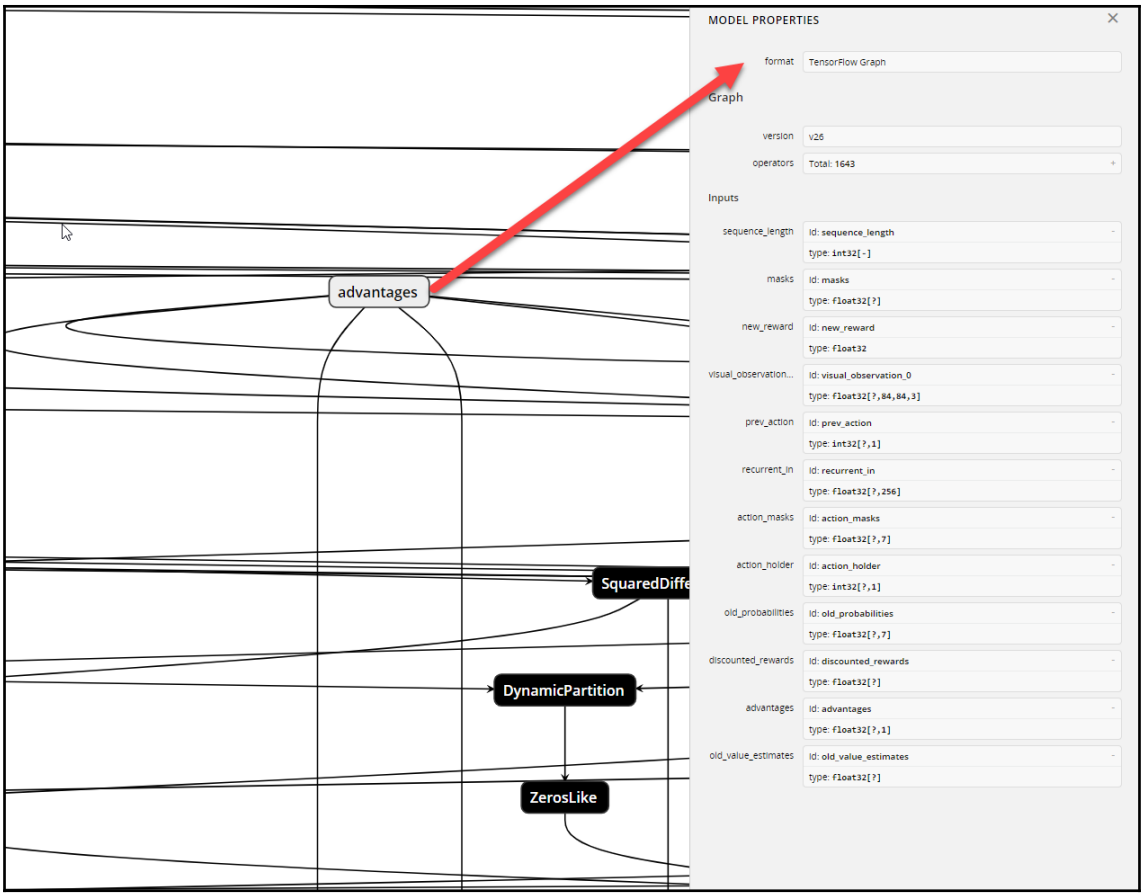

Anaconda Prompt - mlagents-learn config/trainer_config.yaml --run-id=visualhallwaylearning --train --save-freq=10000
is TensorFlow binary was not compiled to use: AVX2
INFO:mlagents.envs:Hyperparameters for the PPO Trainer of brain VisualHallwayLearning:
batch_size: 64
beta: 0.01
buffer_size: 1024
epsilon: 0.2
gamma: 0.99
hidden_units: 128
lambd: 0.95
learning_rate: 0.0003
max_steps: 5.0e5
normalize: False
num_epoch: 3
num_layers: 1
time_horizon: 64
sequence_length: 64
summary_freq: 1000
use_recurrent: True
summary_path: ./summaries/visualhallwaylearning-0_VisualHallwayLearning
memory_size: 256
use_curiosity: False
curiosity_strength: 0.01
curiosity_enc_size: 128
model_path: ./models/visualhallwaylearning-0/VisualHallwayLearning
INFO:mlagents.trainers: visualhallwaylearning-0: VisualHallwayLearning: Step: 1000. Mean Reward: -1.002. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: visualhallwaylearning-0: VisualHallwayLearning: Step: 2000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: visualhallwaylearning-0: VisualHallwayLearning: Step: 3000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: visualhallwaylearning-0: VisualHallwayLearning: Step: 4000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: visualhallwaylearning-0: VisualHallwayLearning: Step: 5000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: visualhallwaylearning-0: VisualHallwayLearning: Step: 6000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: visualhallwaylearning-0: VisualHallwayLearning: Step: 7000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: visualhallwaylearning-0: VisualHallwayLearning: Step: 8000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: visualhallwaylearning-0: VisualHallwayLearning: Step: 9000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
INFO:mlagents.envs:Saved Model
INFO:mlagents.trainers: visualhallwaylearning-0: VisualHallwayLearning: Step: 10000. Mean Reward: -1.000. Std of Reward: 0.000. Training.

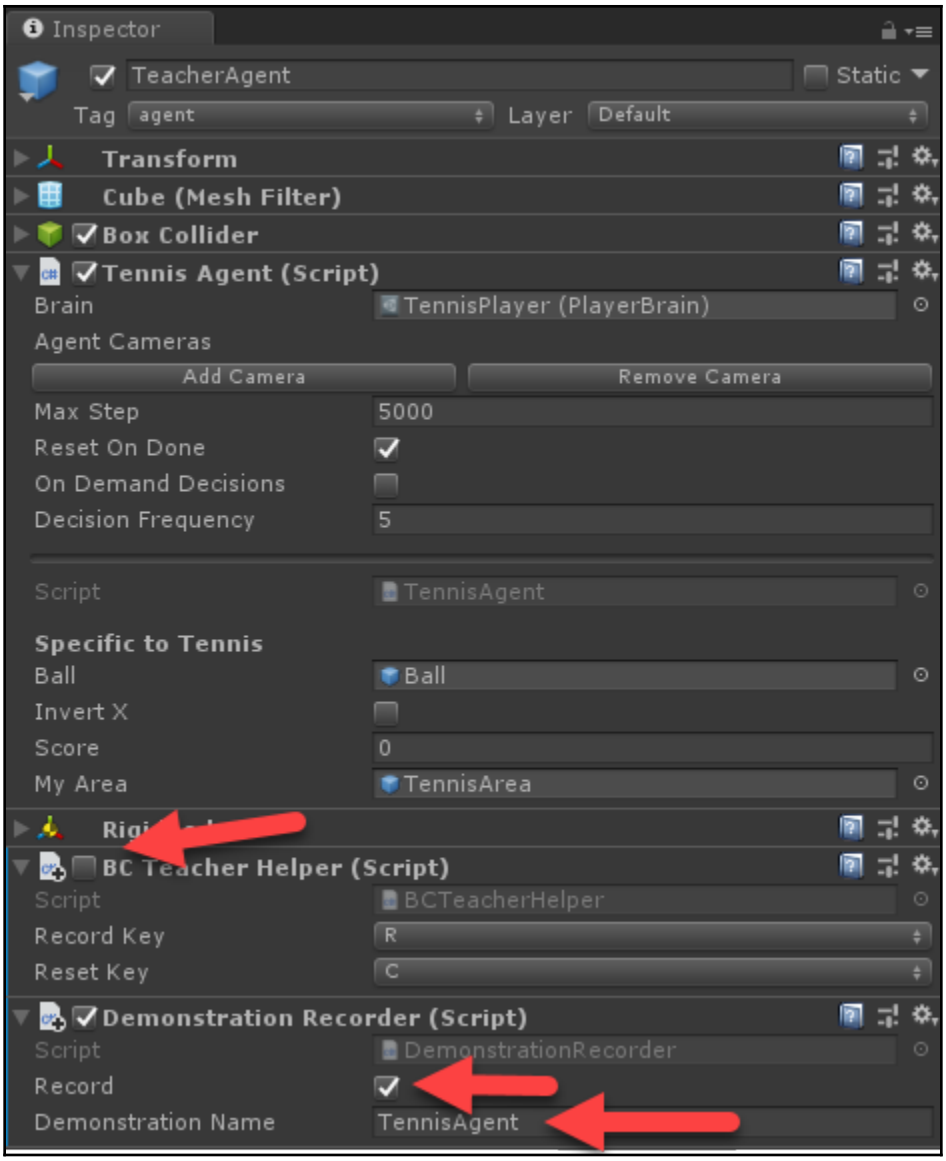

Name
Date modified
Type
Size
VisualHallwayLearning
VisualHallwayLearning.bytes
Name
Date modified
Type
Size
VisualPushBlockLearning
2/9/2019 2:10 PM
File folder
VisualPushBlockLearning.bytes
2/9/2019 2:10 PM
BYTES File
1,897 KB

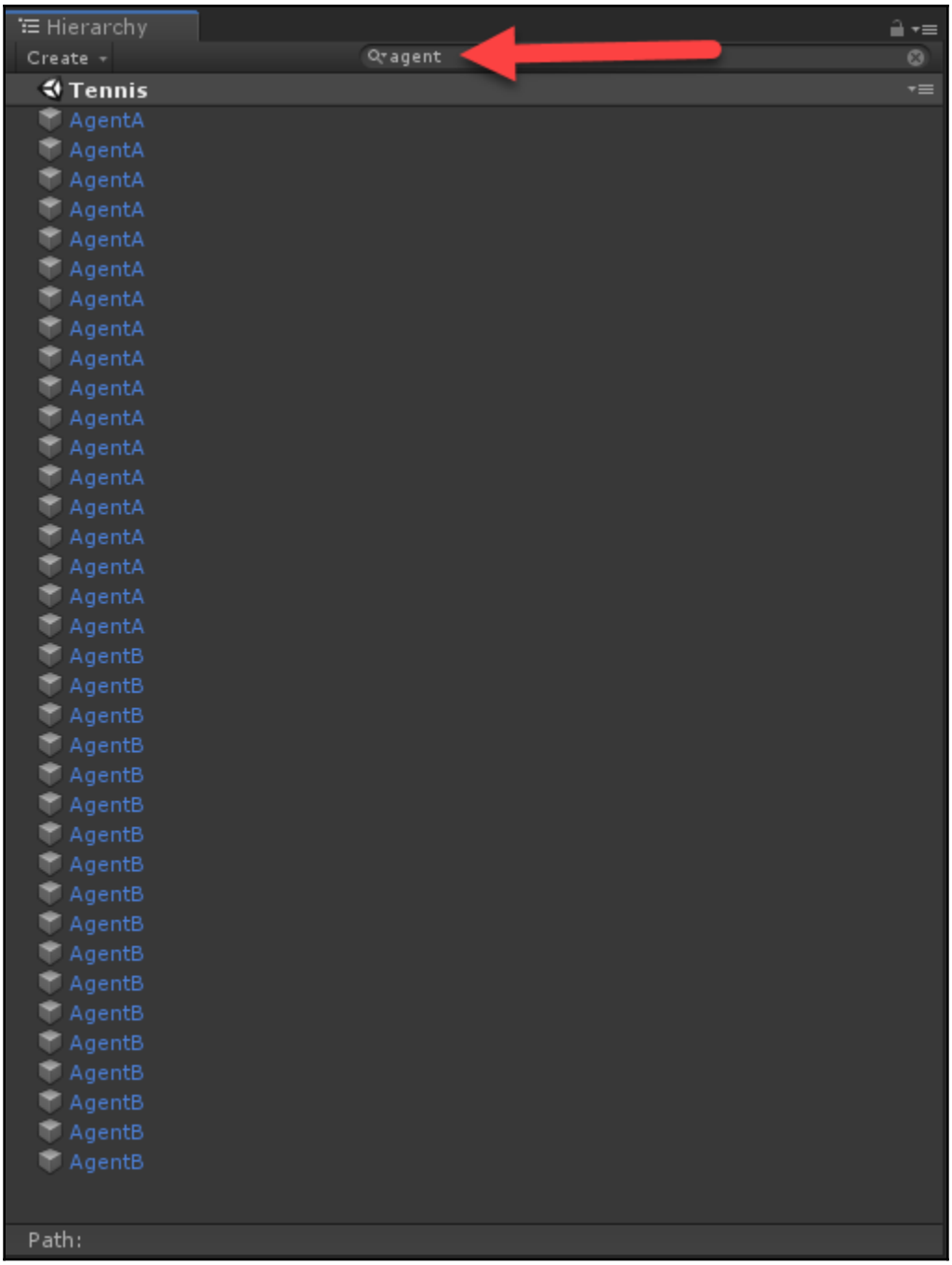

Netron
File
Edit
View
Help
Open Model...


Open
ML-Agents › ml-agents › models › vishall-0 › VisualHallwayLearning
Search VisualHallwayLearning
Organize
New folder
Tutorial_Autoen
Creative Cloud Fil
Dropbox
OneDrive
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
Name
Date modified
Type
Size
model-10000.cptk 2/9/2019 2:05 PM META File 350 KB
model-11978.cptk 2/9/2019 2:07 PM META File 350 KB
model-12568.cptk 2/9/2019 2:10 PM META File 349 KB
raw_graph_def 2/9/2019 2:10 PM PB File 269 KB
File name: raw_graph_def
All Model Files
Open
Cancel


Shape
Prod
Mul
Sub
Sum
Range
Tile
Tile
Reshape
RealDiv
DynamicPartition
Shape


advantages
SquaredDiffe
DynamicPartition
ZerosLike
MODEL PROPERTIES
format
TensorFlow Graph
Graph
version
v26
operators
Total: 1643
Inputs
sequence_length
Id: sequence_length
type: int32[-]
masks
Id: masks
type: float32[?]
new_reward
Id: new_reward
type: float32
visual_observation...
Id: visual_observation_0
type: float32[?,84,84,3]
prev_action
Id: prev_action
type: int32[?,1]
recurrent_in
Id: recurrent_in
type: float32[?,256]
action_masks
Id: action_masks
type: float32[?,7]
action_holder
Id: action_holder
type: int32[?,1]
old_probabilities
Id: old_probabilities
type: float32[?,7]
discounted_rewards
Id: discounted_rewards
type: float32[?]
advantages
Id: advantages
type: float32[?,1]
old_value_estimates
Id: old_value_estimates
type: float32[?]


Inspector
TeacherAgent
Static
Tag agent
Layer Default
Transform
Cube (Mesh Filter)
Box Collider
Tennis Agent (Script)
Brain TennisPlayer (PlayerBrain)
Agent Cameras
Add Camera
Remove Camera
Max Step 5000
Reset On Done
On Demand Decisions
Decision Frequency 5
Script TennisAgent
Specific to Tennis
Ball Ball
Invert X
Score 0
My Area TennisArea
BC Teacher Helper (Script)
Script BCTeacherHelper
Record Key R
Reset Key C
Demonstration Recorder (Script)
Script DemonstrationRecorder
Record
Demonstration Name TennisAgent


Hierarchy
Create
agent
Tennis
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentA
AgentB
AgentB
AgentB
AgentB
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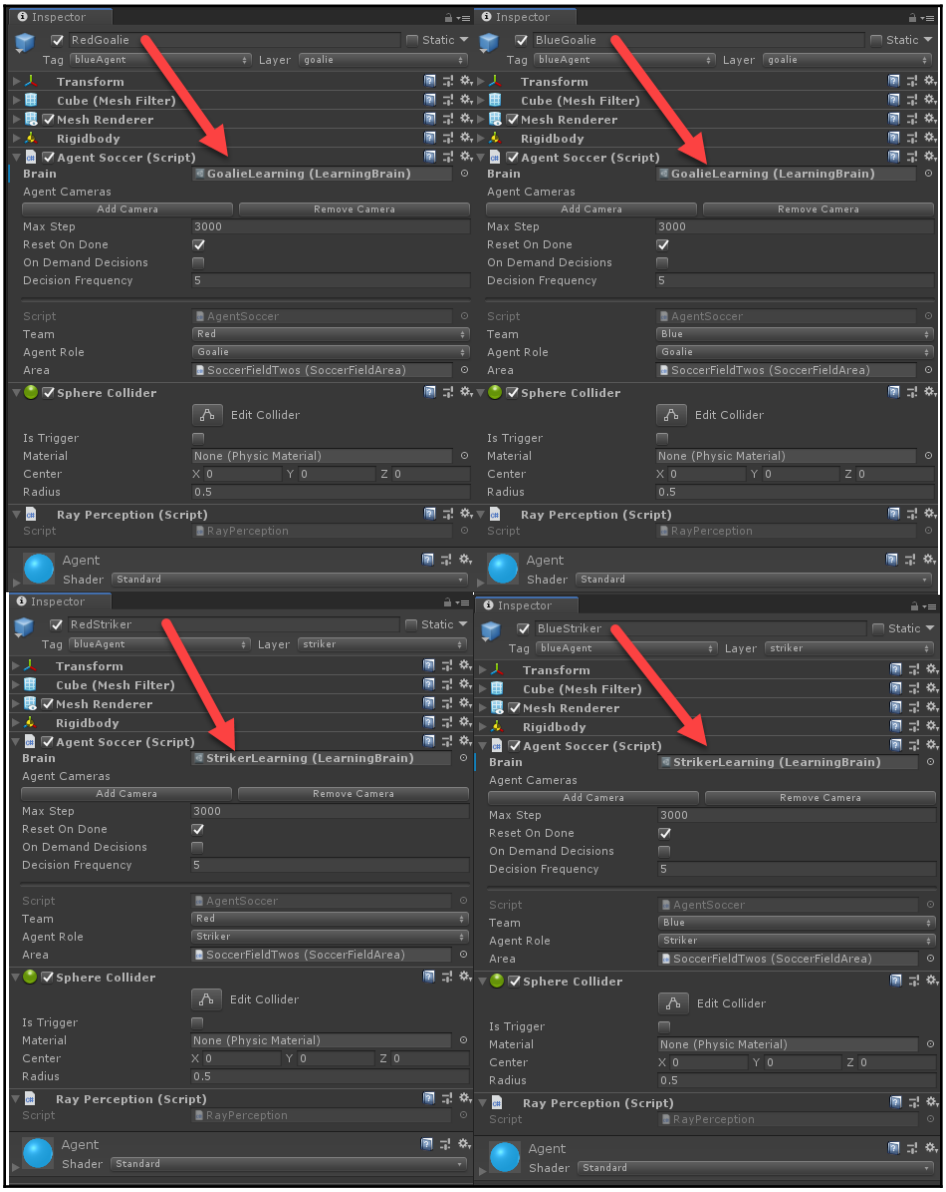
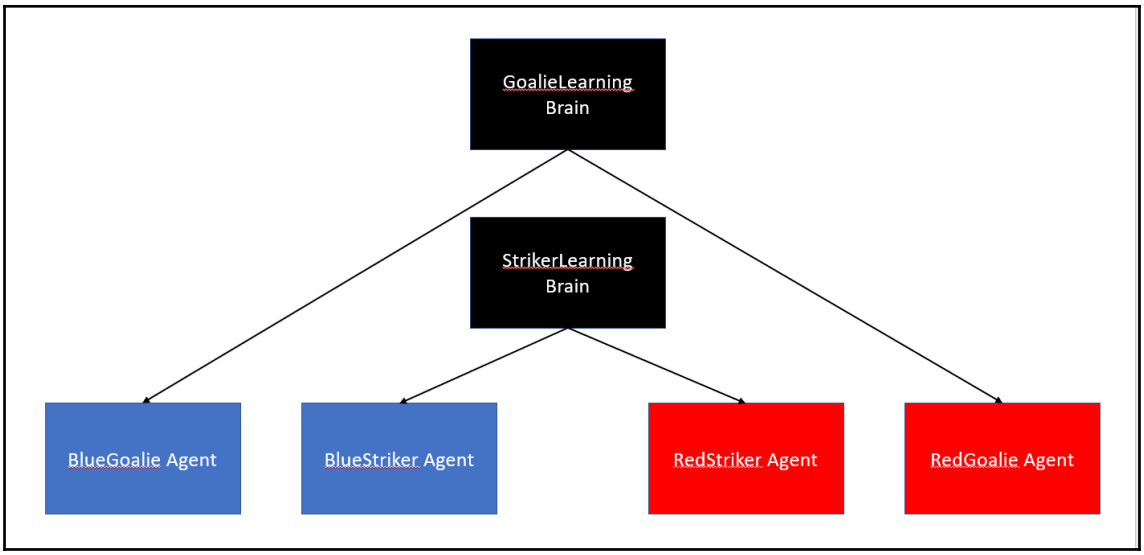
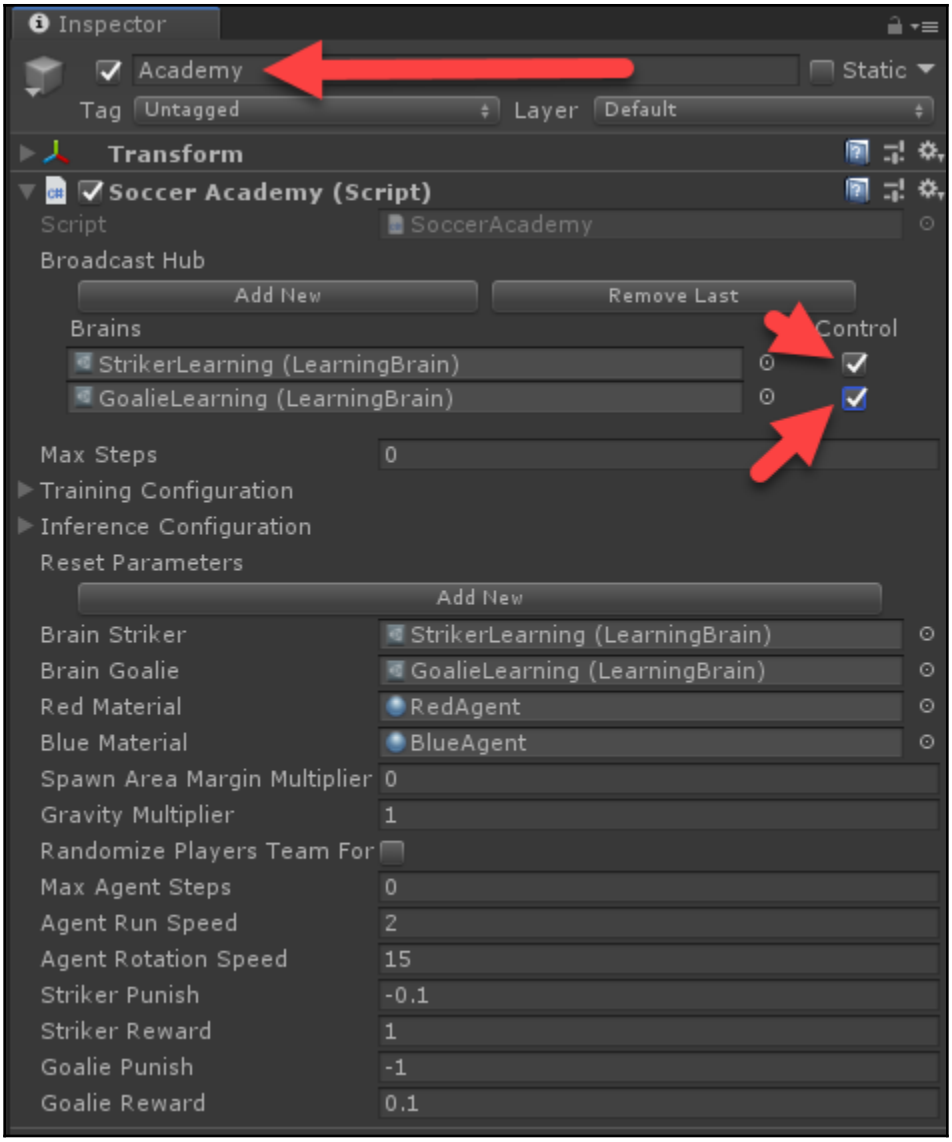
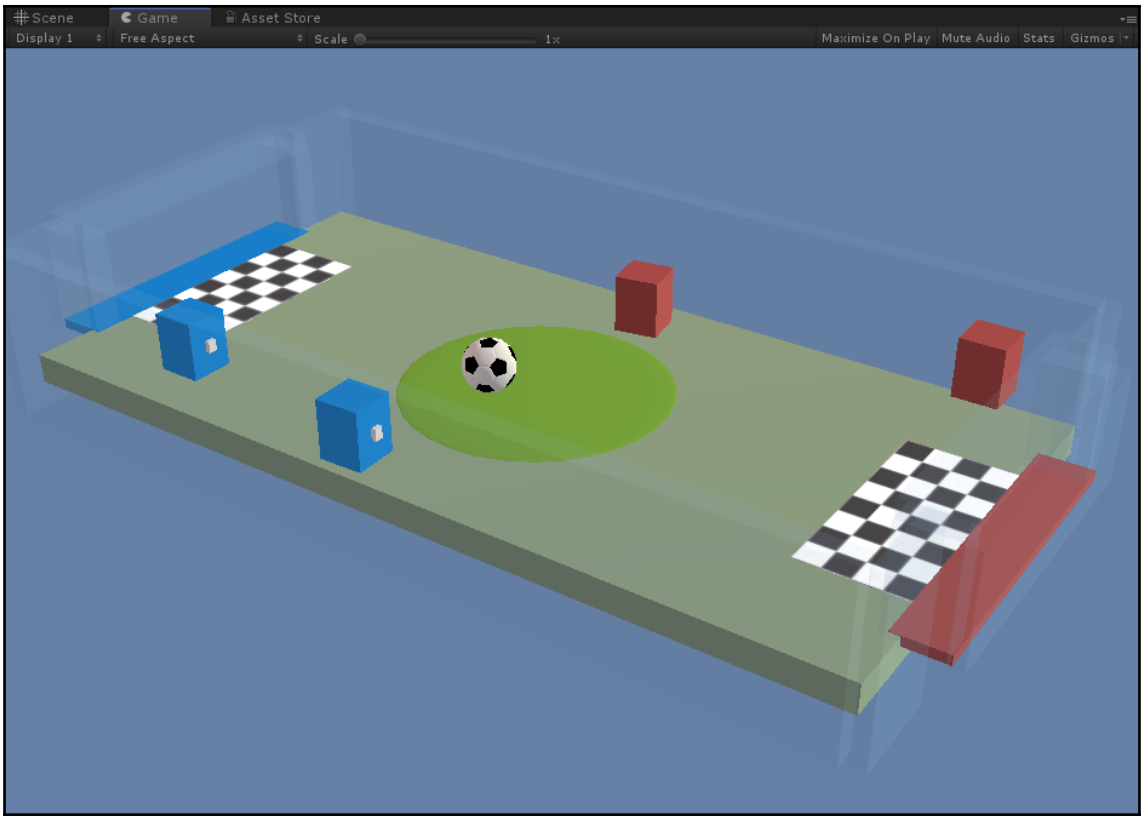
AgentB
AgentB
AgentB
AgentB
AgentB
AgentB
AgentB
AgentB
AgentB
AgentB
AgentB
AgentB
AgentB
Path:

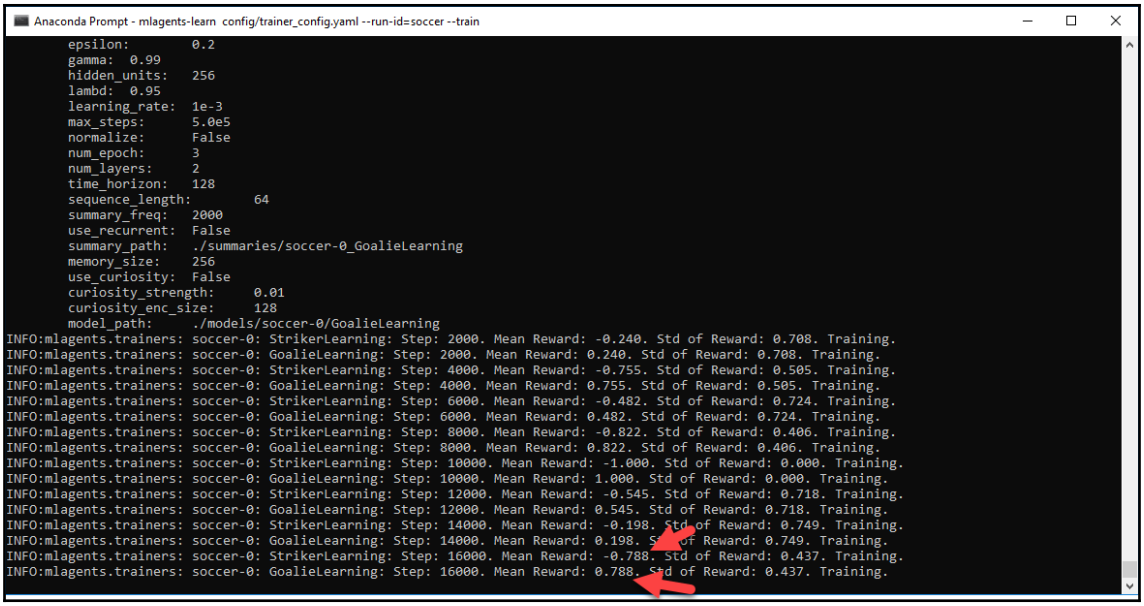
Chapter 11: Building Multi-Agent Environments

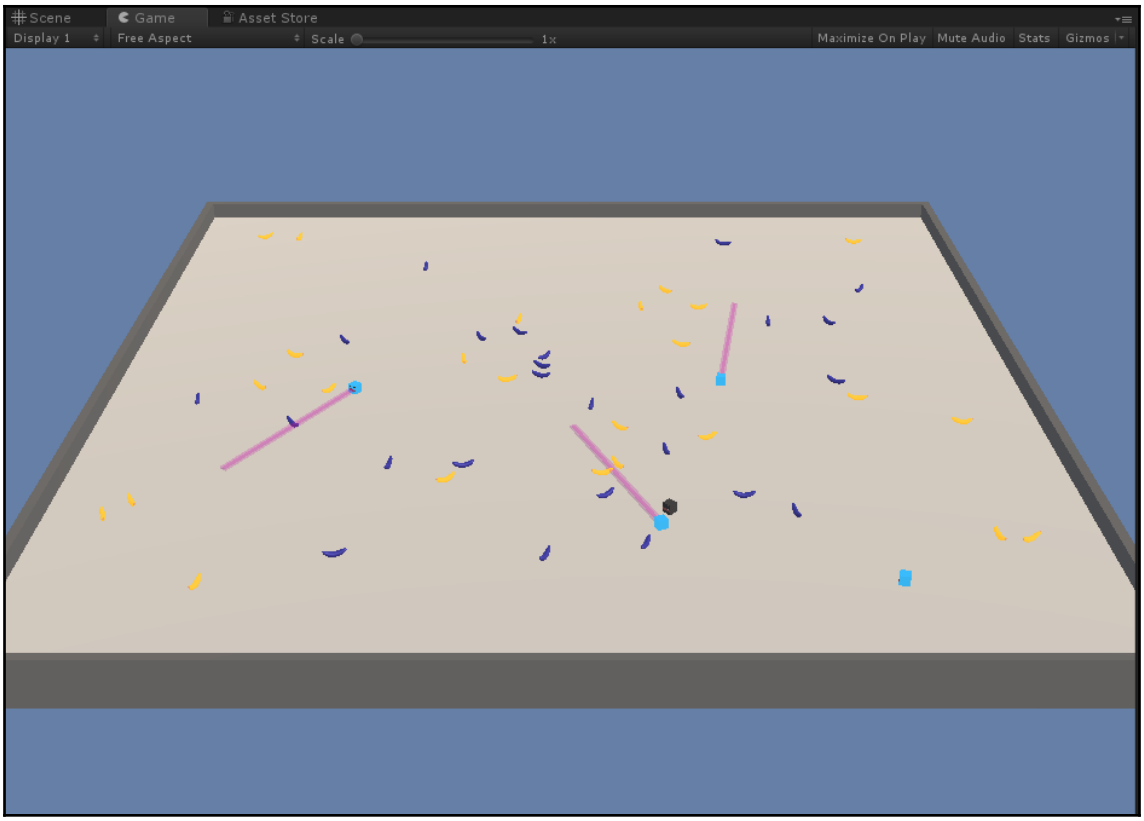


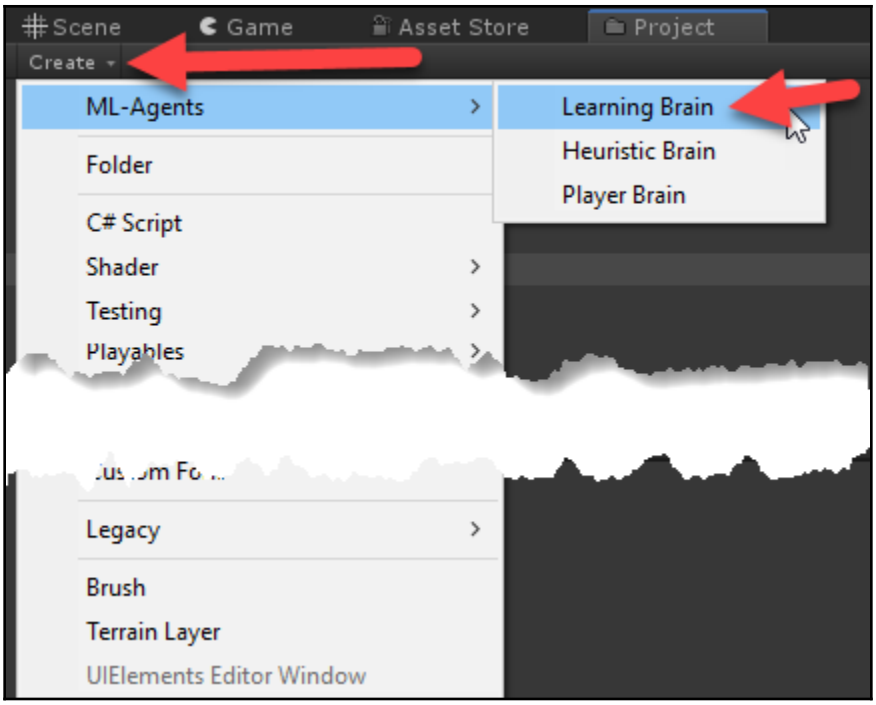

GoalieLearning Brain
StrikerLearning Brain
BlueGoalie Agent
BlueStriker Agent
RedStriker Agent
RedGoalie Agent

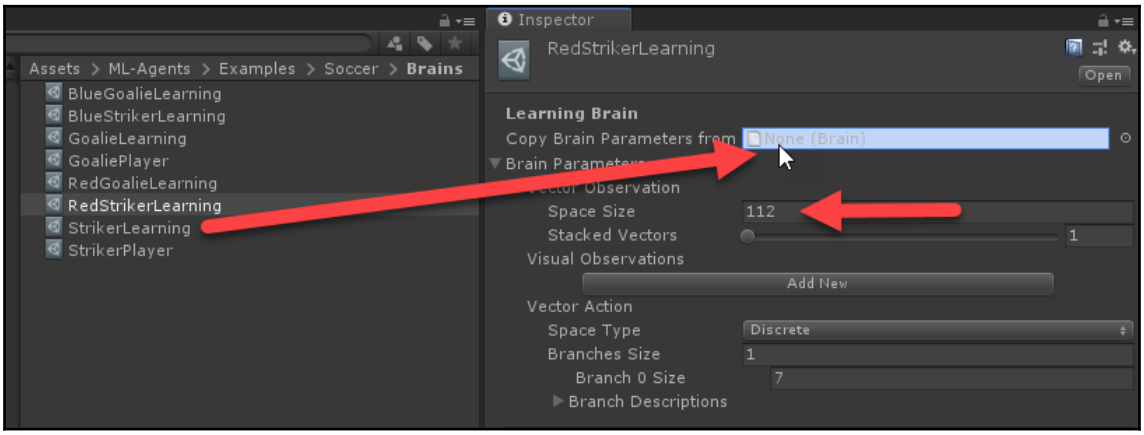

Inspector
Academy
Static
Tag
Untagged
Layer
Default
Transform
Soccer Academy (Script)
Script
SoccerAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
StrikerLearning (LearningBrain)
GoalieLearning (LearningBrain)
Max Steps
0
Training Configuration
Inference Configuration
Reset Parameters
Add New
Brain Striker
StrikerLearning (LearningBrain)
Brain Goalie
GoalieLearning (LearningBrain)
Red Material
RedAgent
Blue Material
BlueAgent
Spawn Area Margin Multiplier
0
Gravity Multiplier
1
Randomize Players Team For
Max Agent Steps
0
Agent Run Speed
2
Agent Rotation Speed
15
Striker Punish
-0.1
Striker Reward
1
Goalie Punish
-1
Goalie Reward
0.1

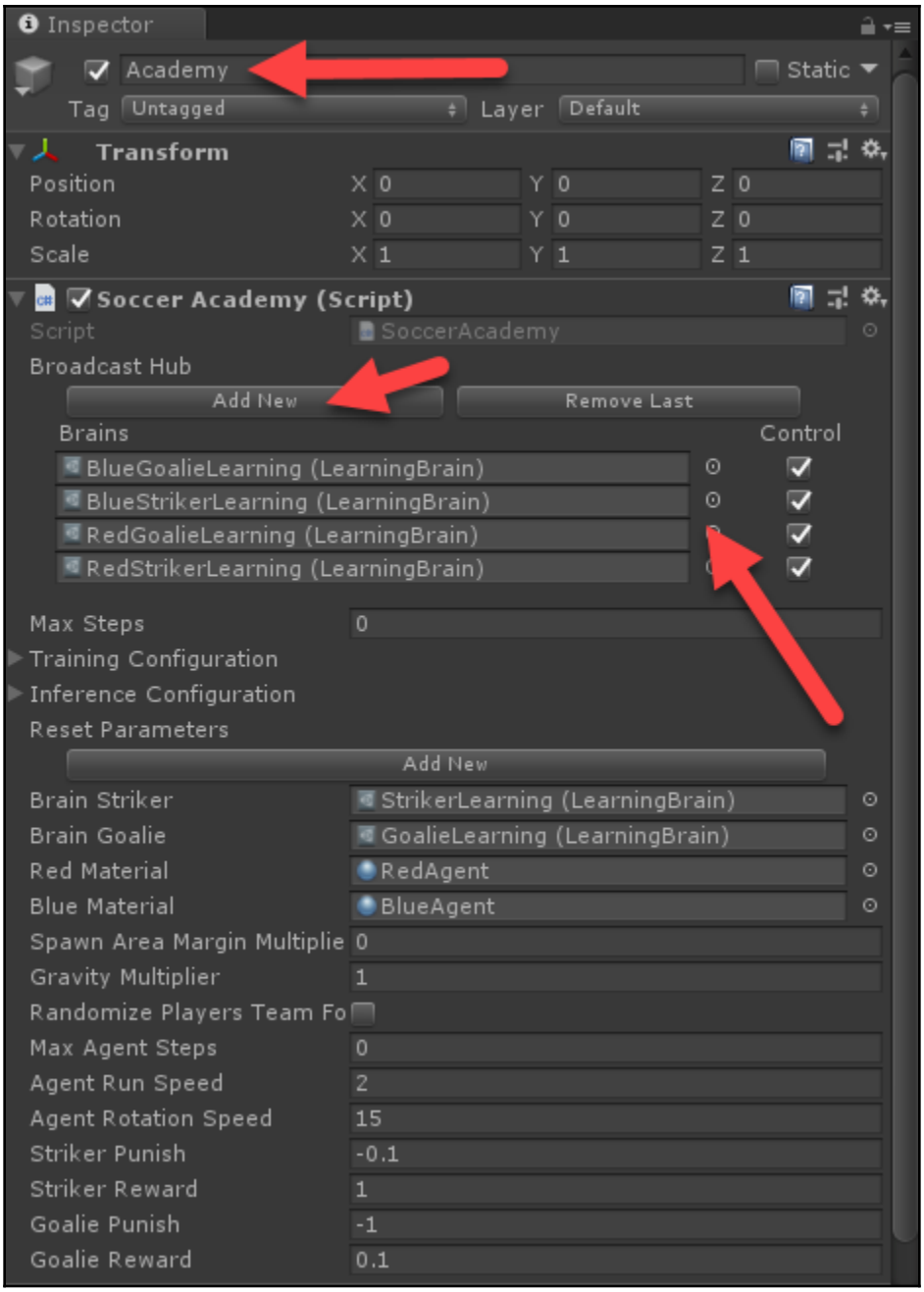

Scene
Game
Asset Store
Display 1
Free Aspect
Scale
1x
Maximize On Play
Mute Audio
Stats
Gizmos

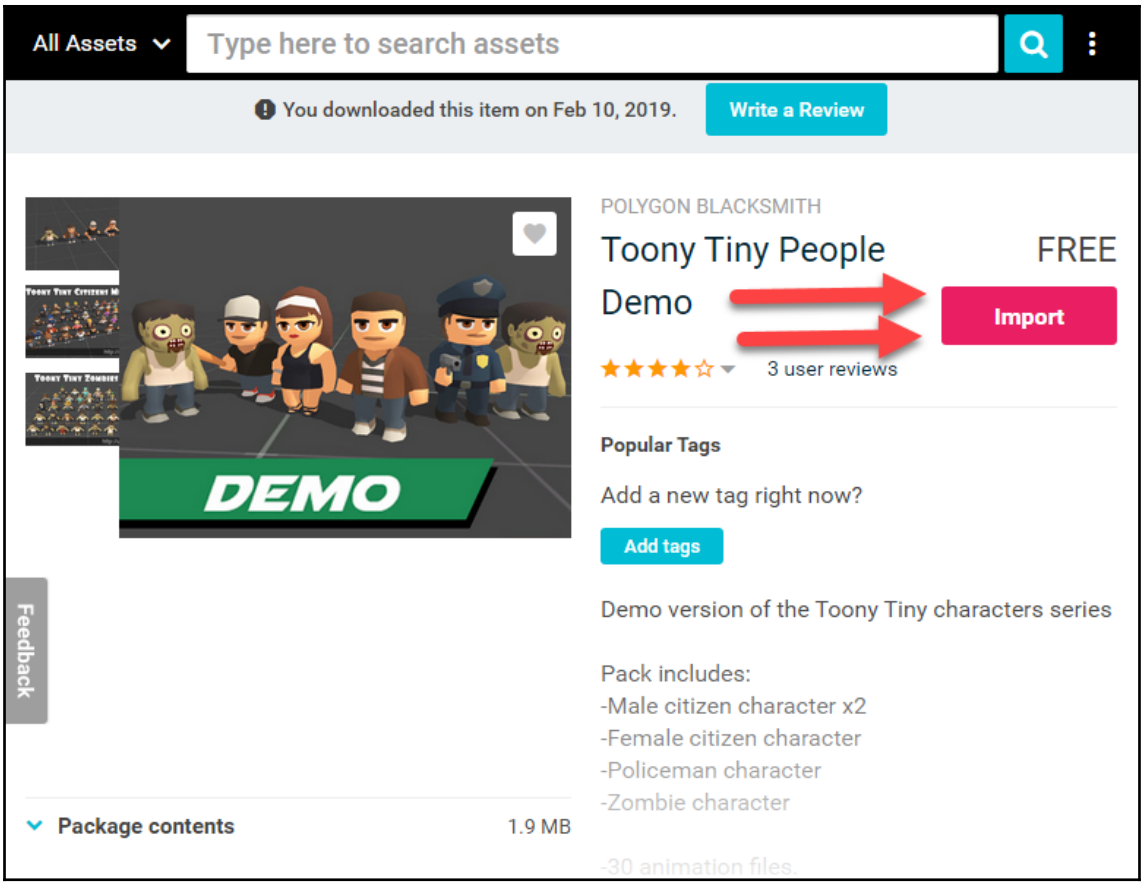

Anaconda Prompt - mlagents-learn config/trainer_config.yaml --run-id=soccer --train
epsilon: 0.2
gamma: 0.99
hidden_units: 256
lambd: 0.95
learning_rate: 1e-3
max_steps: 5.0e5
normalize: False
num_epoch: 3
num_layers: 2
time_horizon: 128
sequence_length: 64
summary_freq: 2000
use_recurrent: False
summary_path: ./summaries/soccer-0_GoalieLearning
memory_size: 256
use_curiosity: False
curiosity_strength: 0.01
curiosity_enc_size: 128
model_path: ./models/soccer-0/GoalieLearning
INFO:mlagents.trainers: soccer-0: StrikerLearning: Step: 2000. Mean Reward: -0.240. Std of Reward: 0.708. Training.
INFO:mlagents.trainers: soccer-0: GoalieLearning: Step: 2000. Mean Reward: 0.240. Std of Reward: 0.708. Training.
INFO:mlagents.trainers: soccer-0: StrikerLearning: Step: 4000. Mean Reward: -0.755. Std of Reward: 0.505. Training.
INFO:mlagents.trainers: soccer-0: GoalieLearning: Step: 4000. Mean Reward: 0.755. Std of Reward: 0.505. Training.
INFO:mlagents.trainers: soccer-0: StrikerLearning: Step: 6000. Mean Reward: -0.482. Std of Reward: 0.724. Training.
INFO:mlagents.trainers: soccer-0: GoalieLearning: Step: 6000. Mean Reward: 0.482. Std of Reward: 0.724. Training.
INFO:mlagents.trainers: soccer-0: StrikerLearning: Step: 8000. Mean Reward: -0.822. Std of Reward: 0.406. Training.
INFO:mlagents.trainers: soccer-0: GoalieLearning: Step: 8000. Mean Reward: 0.822. Std of Reward: 0.406. Training.
INFO:mlagents.trainers: soccer-0: StrikerLearning: Step: 10000. Mean Reward: -1.000. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: soccer-0: GoalieLearning: Step: 10000. Mean Reward: 1.000. Std of Reward: 0.000. Training.
INFO:mlagents.trainers: soccer-0: StrikerLearning: Step: 12000. Mean Reward: -0.545. Std of Reward: 0.718. Training.
INFO:mlagents.trainers: soccer-0: GoalieLearning: Step: 12000. Mean Reward: 0.545. Std of Reward: 0.718. Training.
INFO:mlagents.trainers: soccer-0: StrikerLearning: Step: 14000. Mean Reward: -0.198. Std of Reward: 0.749. Training.
INFO:mlagents.trainers: soccer-0: GoalieLearning: Step: 14000. Mean Reward: 0.198. Std of Reward: 0.749. Training.
INFO:mlagents.trainers: soccer-0: StrikerLearning: Step: 16000. Mean Reward: -0.788. Std of Reward: 0.437. Training.
INFO:mlagents.trainers: soccer-0: GoalieLearning: Step: 16000. Mean Reward: 0.788. Std of Reward: 0.437. Training.

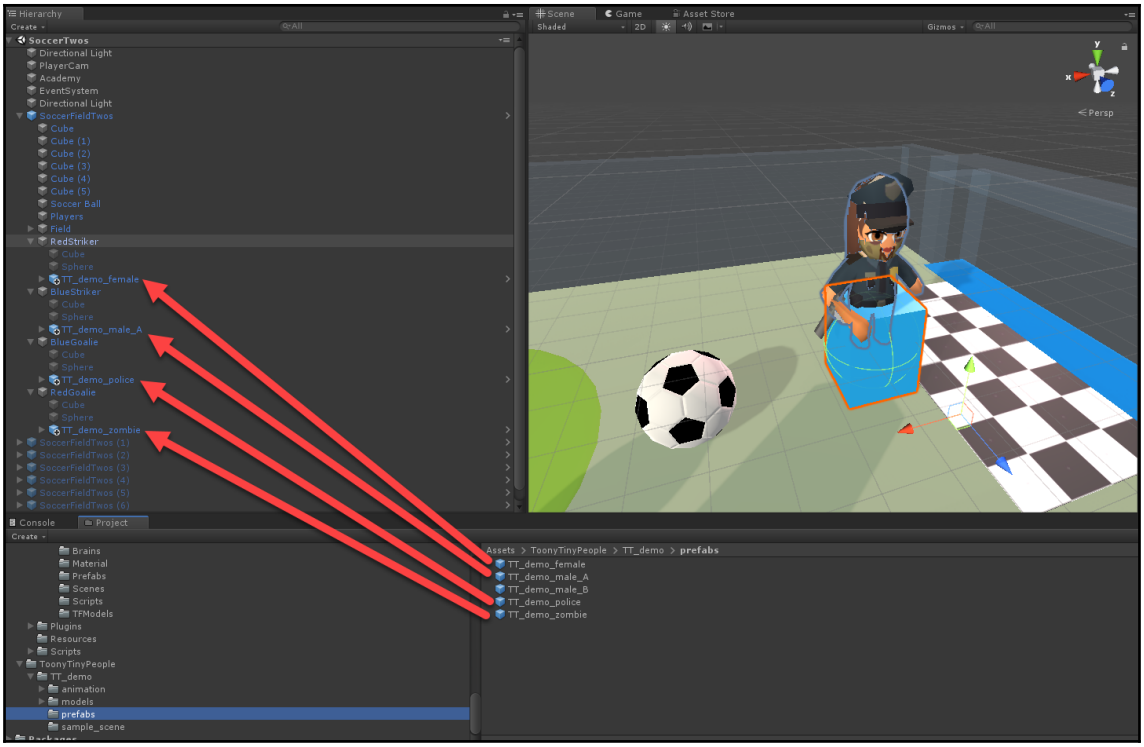

Scene
Game
Asset Store
Display 1
Free Aspect
Scale
1x
Maximize On Play
Mute Audio
Stats
Gizmos

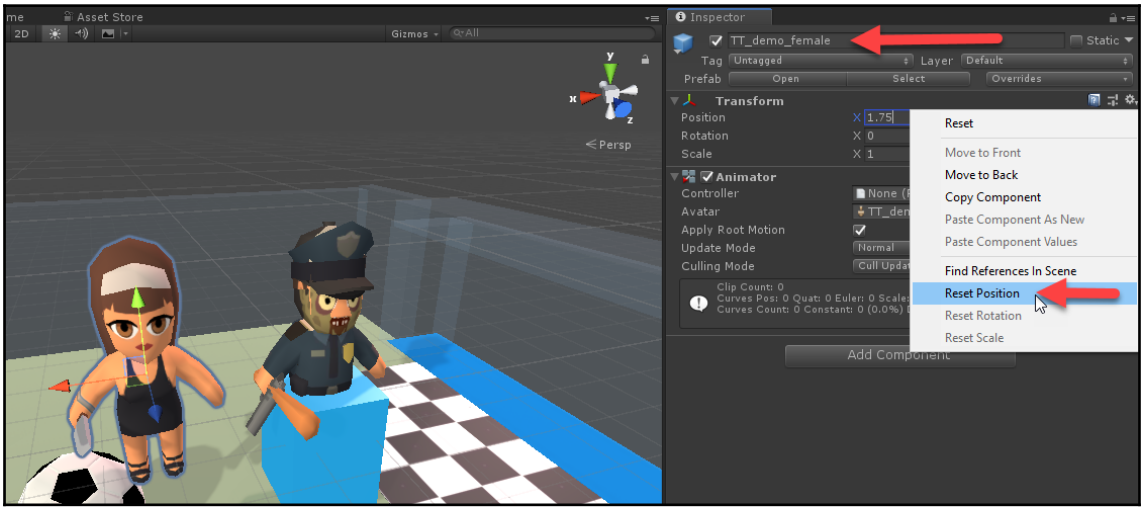

Scene
Game
Asset Store
Project
Create
ML-Agents
Learning Brain
Heuristic Brain
Player Brain
Folder
C# Script
Shader
Testing
Playables
Legacy
Brush
Terrain Layer
UIElements Editor Window

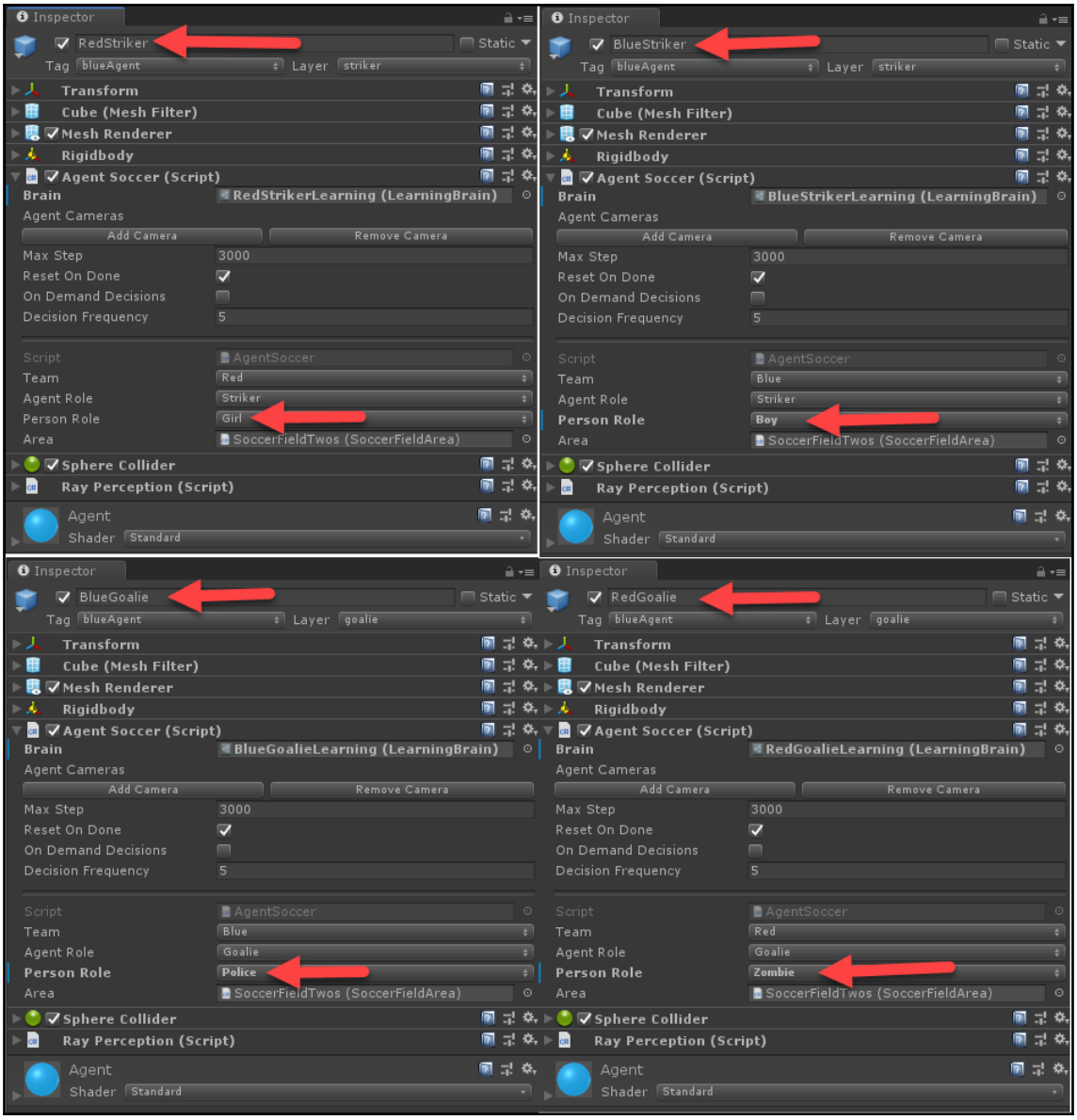

Assets > ML-Agents > Examples > Soccer > Brains
BlueGoalieLearning
BlueStrikerLearning
GoalieLearning
GoaliePlayer
RedGoalieLearning
RedStrikerLearning
StrikerLearning
StrikerPlayer
Inspector
RedStrikerLearning
Open
Learning Brain
Copy Brain Parameters from
None (Brain)
Brain Parameters
Space Size
112
Stacked Vectors
1
Visual Observations
Add New
Vector Action
Space Type
Discrete
Branches Size
1
Branch 0 Size
7
Branch Descriptions


Inspector
Academy
Static
Tag Untagged
Layer Default
Transform
Position X 0 Y 0 Z 0
Rotation X 0 Y 0 Z 0
Scale X 1 Y 1 Z 1
Soccer Academy (Script)
Script SoccerAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
BlueGoalieLearning (LearningBrain)
BlueStrikerLearning (LearningBrain)
RedGoalieLearning (LearningBrain)
RedStrikerLearning (LearningBrain)
Max Steps 0
Training Configuration
Inference Configuration
Reset Parameters
Add New
Brain Striker StrikerLearning (LearningBrain)
Brain Goalie GoalieLearning (LearningBrain)
Red Material RedAgent
Blue Material BlueAgent
Spawn Area Margin Multiplie 0
Gravity Multiplier 1
Randomize Players Team Fo
Max Agent Steps 0
Agent Run Speed 2
Agent Rotation Speed 15
Striker Punish -0.1
Striker Reward 1
Goalie Punish -1
Goalie Reward 0.1


All Assets
Type here to search assets
You downloaded this item on Feb 10, 2019.
Write a Review
DEMO
POLYGON BLACKSMITH
Toony Tiny People Demo
FREE
Import
3 user reviews
Popular Tags
Add a new tag right now?
Add tags
Demo version of the Toony Tiny characters series
Pack includes:
-Male citizen character x2
-Female citizen character
-Policeman character
-Zombie character
-30 animation files.
Feedback
Package contents
1.9 MB


Hierarchy
SoccerTwos
Directional Light
PlayerCam
Academy
EventSystem
Directional Light
SoccerFieldTwos
Cube
Cube (1)
Cube (2)
Cube (3)
Cube (4)
Cube (5)
Soccer Ball
Players
Field
RedStriker
BlueStriker
BlueGoalie
RedGoalie
TT_demo_female
TT_demo_male_A
TT_demo_police
TT_demo_zombie
Scene
Game
Asset Store
Persp
Console
Project
Assets > ToonyTinyPeople > TT_demo > prefabs
TT_demo_female
TT_demo_male_A
TT_demo_male_B
TT_demo_police
TT_demo_zombie
Brains
Material
Prefabs
Scenes
Scripts
TFModels
Plugins
Resources
Scripts
ToonyTinyPeople
TT_demo
animation
models
prefabs
sample_scene

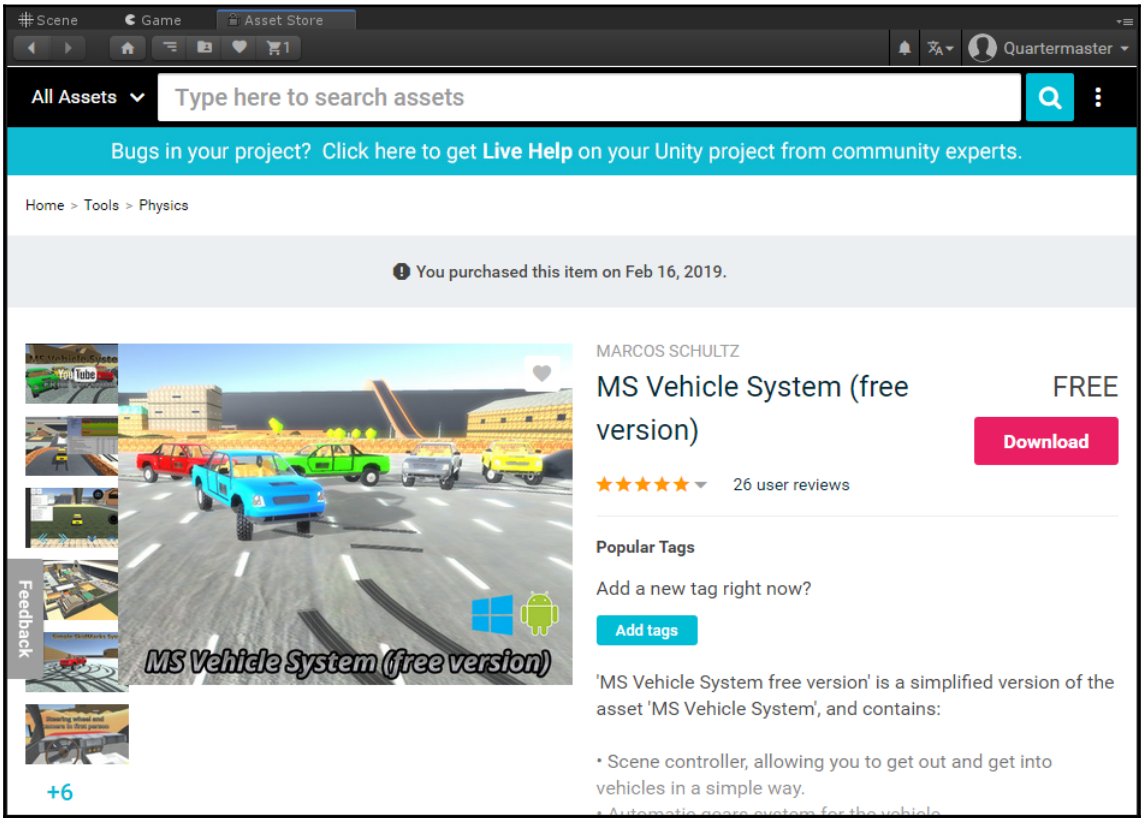

Asset Store
Gizmos
Persp
Inspector
TT_demo_female
Static
Tag
Untagged
Layer
Default
Prefab
Open
Select
Overrides
Transform
Position
Rotation
Scale
Animator
Controller
Avatar
Apply Root Motion
Update Mode
Culling Mode
Reset
Move to Front
Move to Back
Copy Component
Paste Component As New
Paste Component Values
Find References In Scene
Reset Position
Reset Rotation
Reset Scale
Add Component

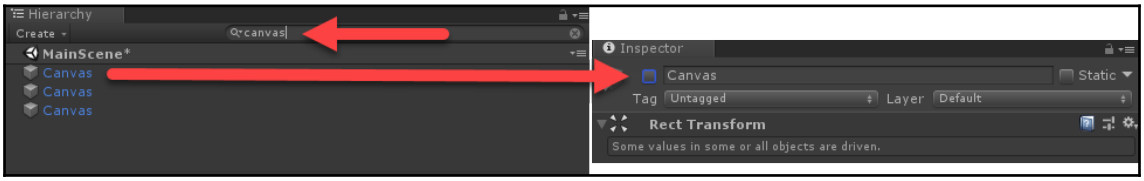

Inspector
RedStriker
Static
Tag blueAgent
Layer striker
Transform
Cube (Mesh Filter)
Mesh Renderer
Rigidbody
Agent Soccer (Script)
Brain RedStrikerLearning (LearningBrain)
Agent Cameras
Add Camera
Remove Camera
Max Step 3000
Reset On Done
On Demand Decisions
Decision Frequency 5
Script AgentSoccer
Team Red
Agent Role Striker
Person Role Girl
Area SoccerFieldTwos (SoccerFieldArea)
Sphere Collider
Ray Perception (Script)
Agent
Shader Standard
Inspector
BlueStriker
Static
Tag blueAgent
Layer striker
Transform
Cube (Mesh Filter)
Mesh Renderer
Rigidbody
Agent Soccer (Script)
Brain BlueStrikerLearning (LearningBrain)
Agent Cameras
Add Camera
Remove Camera
Max Step 3000
Reset On Done
On Demand Decisions
Decision Frequency 5
Script AgentSoccer
Team Blue
Agent Role Striker
Person Role Boy
Area SoccerFieldTwos (SoccerFieldArea)
Sphere Collider
Ray Perception (Script)
Agent
Shader Standard
Inspector
BlueGoalie
Static
Tag blueAgent
Layer goalie
Transform
Cube (Mesh Filter)
Mesh Renderer
Rigidbody
Agent Soccer (Script)
Brain BlueGoalieLearning (LearningBrain)
Agent Cameras
Add Camera
Remove Camera
Max Step 3000
Reset On Done
On Demand Decisions
Decision Frequency 5
Script AgentSoccer
Team Blue
Agent Role Goalie
Person Role Police
Area SoccerFieldTwos (SoccerFieldArea)
Sphere Collider
Ray Perception (Script)
Agent
Shader Standard
Inspector
RedGoalie
Static
Tag blueAgent
Layer goalie
Transform
Cube (Mesh Filter)
Mesh Renderer
Rigidbody
Agent Soccer (Script)
Brain RedGoalieLearning (LearningBrain)
Agent Cameras
Add Camera
Remove Camera
Max Step 3000
Reset On Done
On Demand Decisions
Decision Frequency 5
Script AgentSoccer
Team Red
Agent Role Goalie
Person Role Zombie
Area SoccerFieldTwos (SoccerFieldArea)
Sphere Collider
Ray Perception (Script)
Agent
Shader Standard

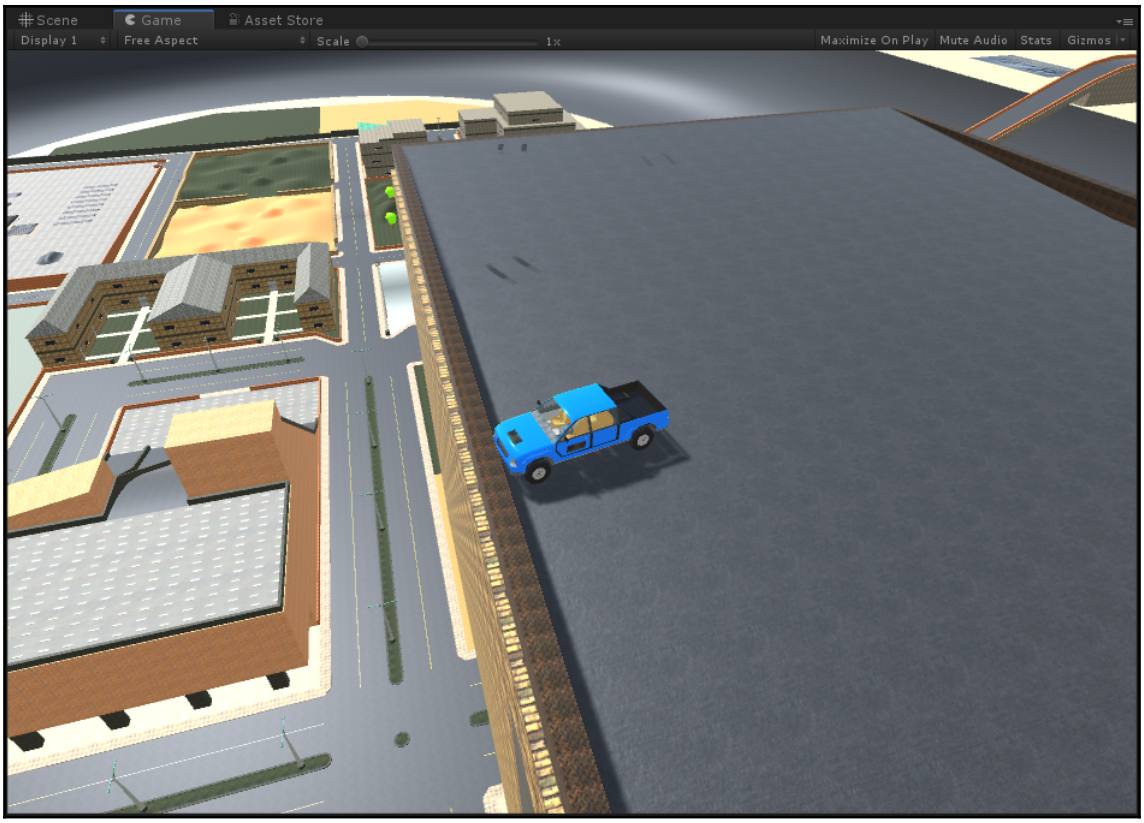
Scene
Game
Asset Store
Display 1
Free Aspect
Scale
1x
Maximize On Play
Mute Audio
Stats
Gizmos

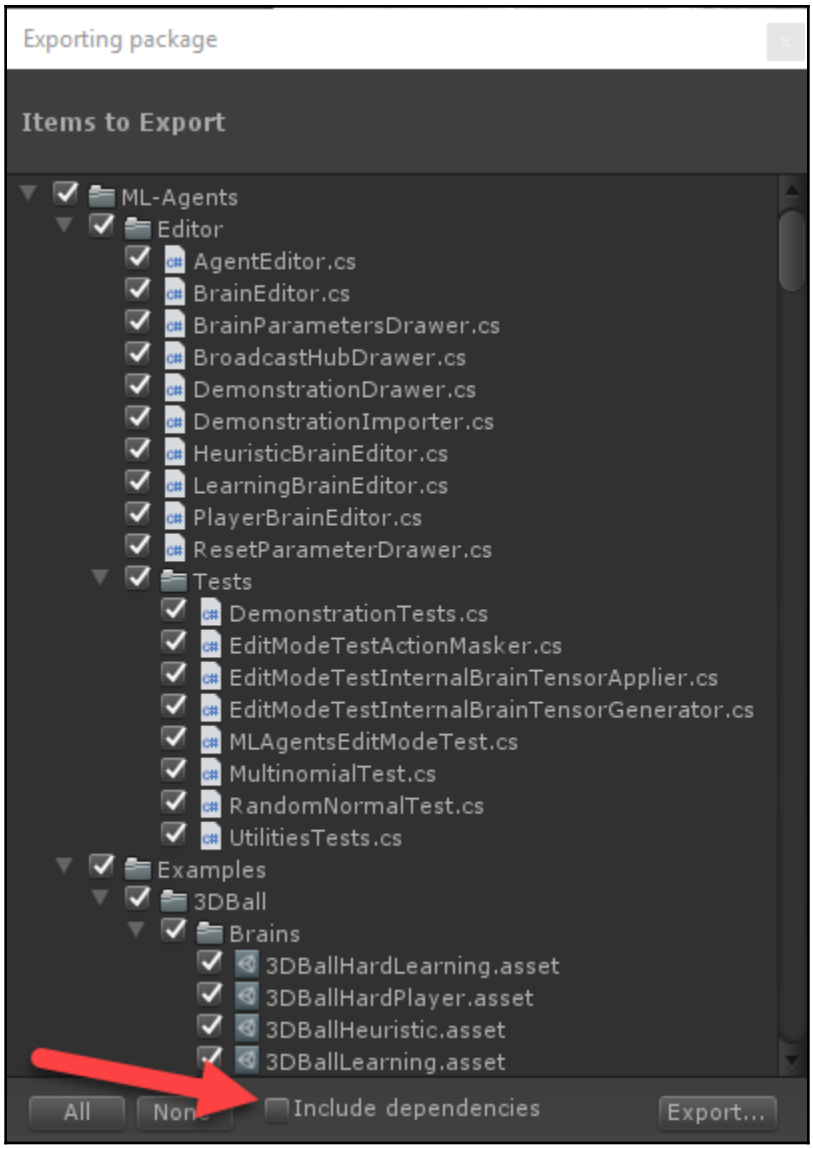
soccer_peeps2-0_BlueGoalieLearning
soccer_peeps2-0_BlueStrikerLearning
soccer_peeps2-0_RedGoalieLearning
soccer_peeps2-0_RedStrikerLearning
Environment/Cumulative Reward
1.00
0.600
0.200
-0.200
-0.600
-1.00
0.000
20.00k
40.00k
60.00k
80.00k
Losses/Policy Loss
0.0800
0.0600
0.0400
0.0200
0.00
10.00k
30.00k
50.00k
70.00k
Losses/Value Loss
0.0160
0.0120
8.000e-3
4.000e-3
0.00
10.00k
30.00k
50.00k
70.00k

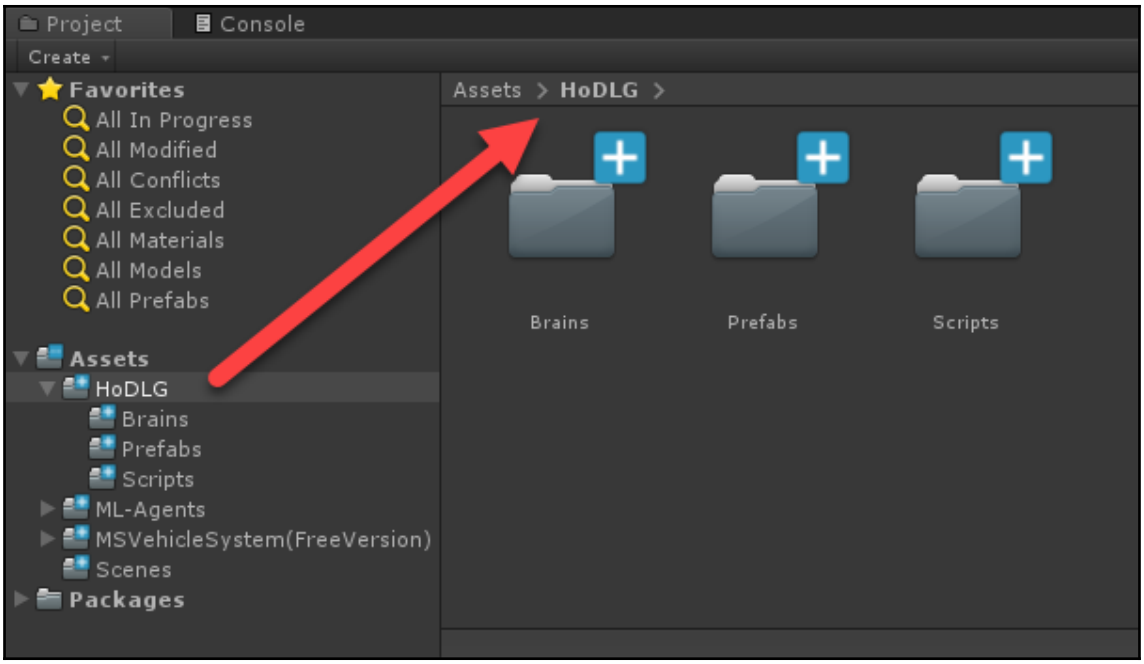
Chapter 12: Debugging/Testing a Game with DRL

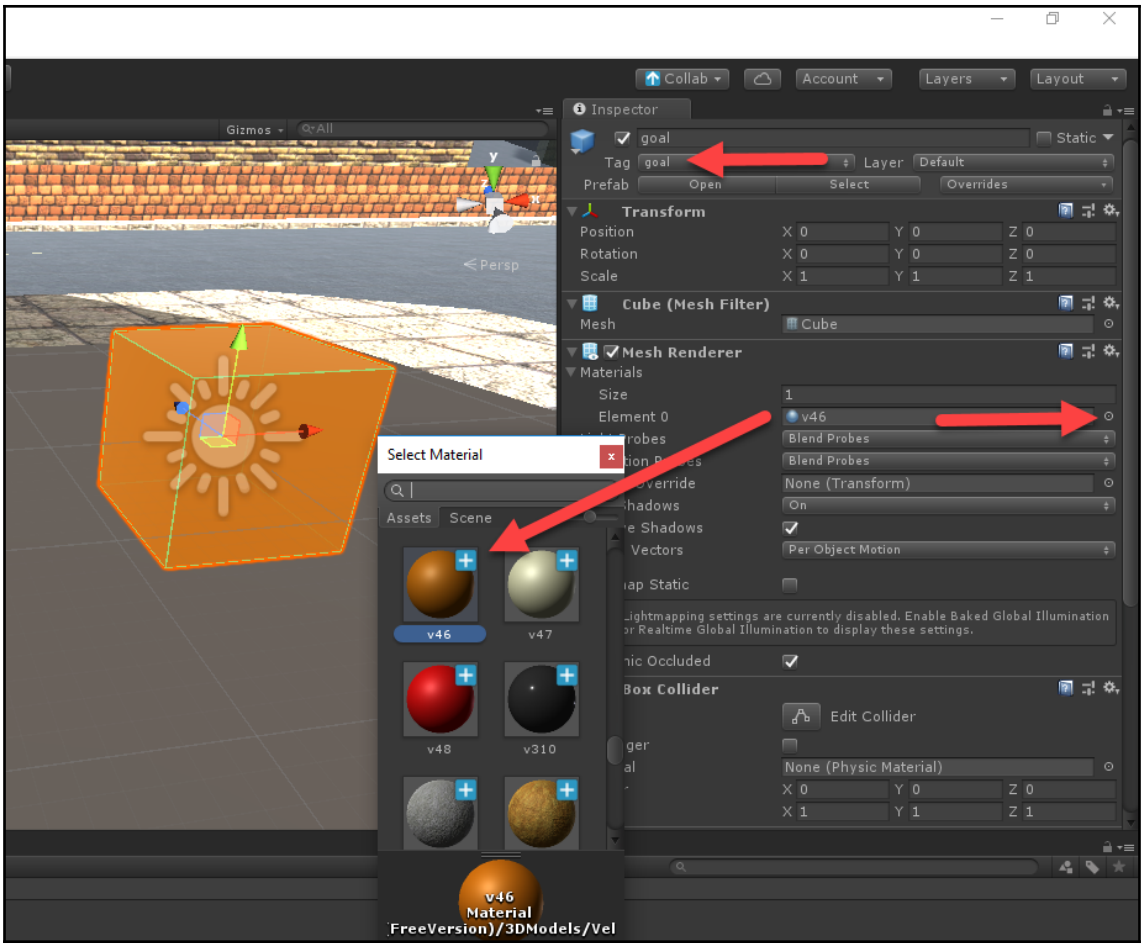


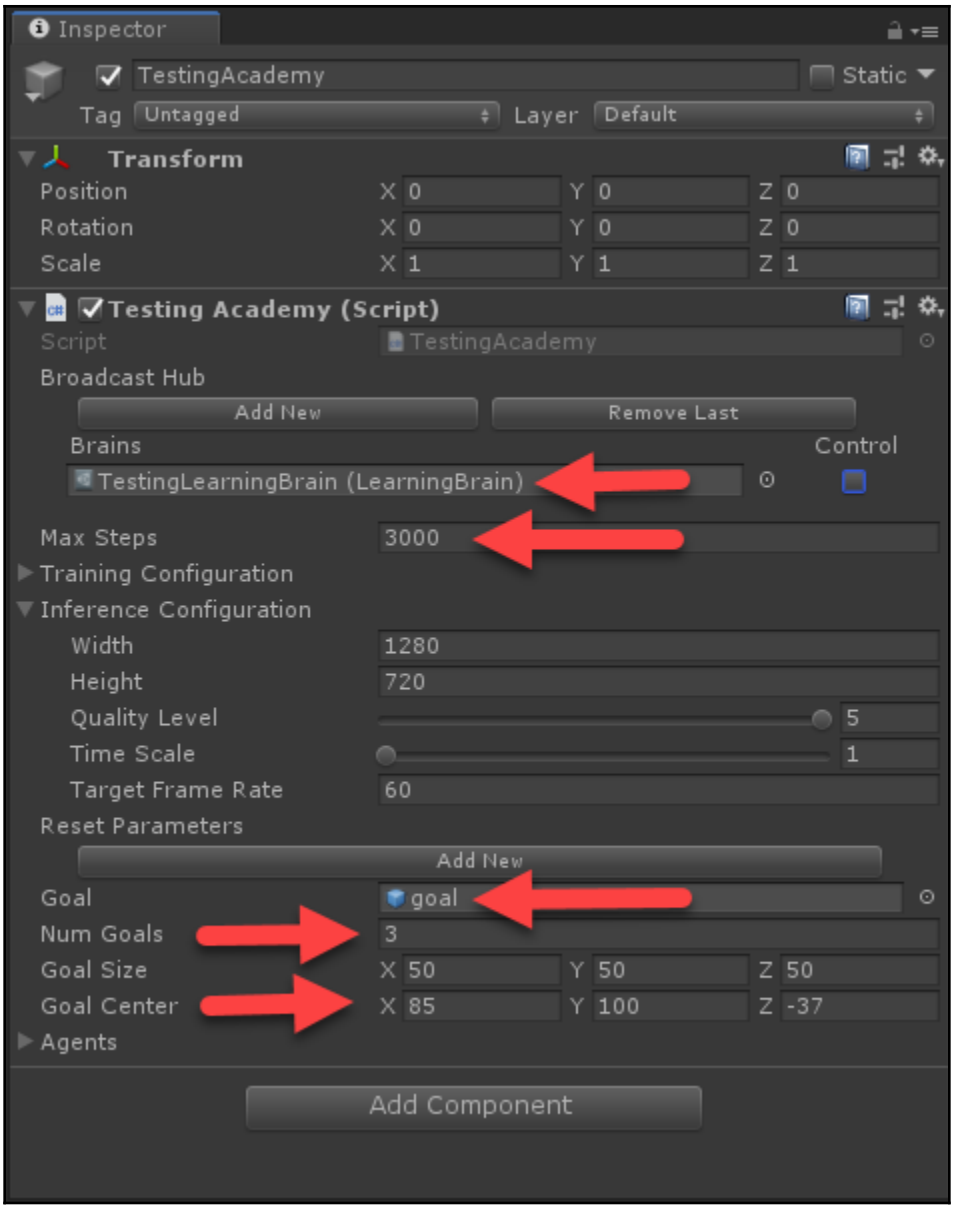


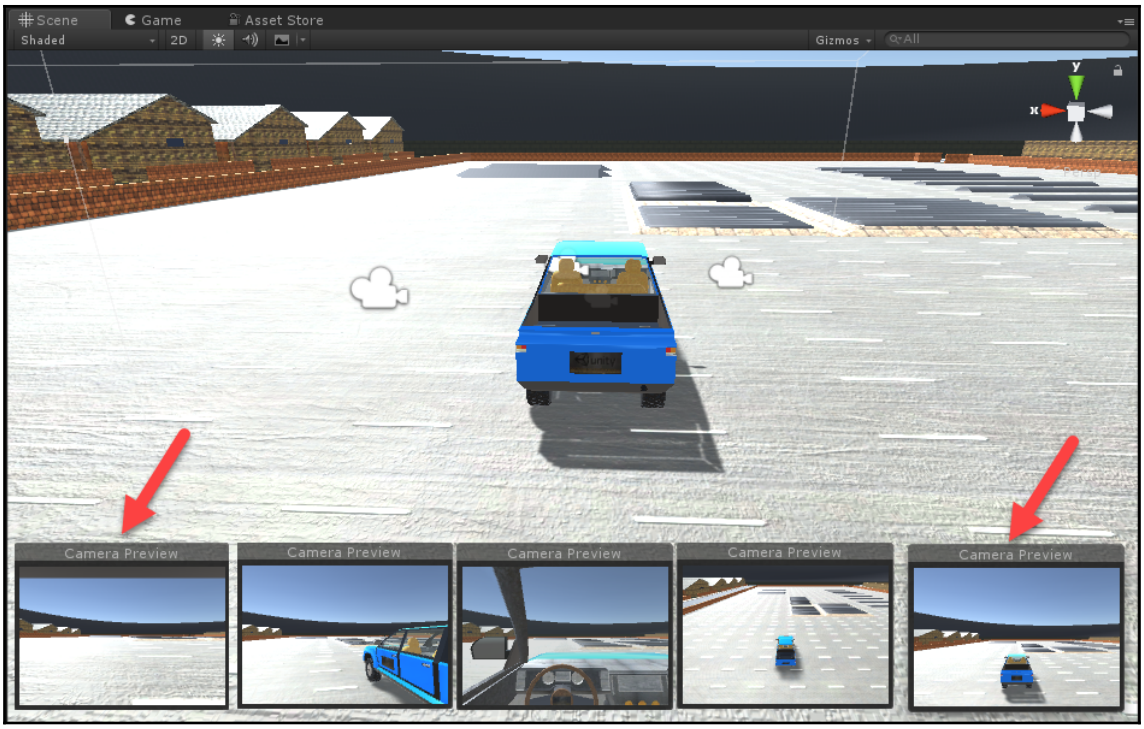

Scene
Game
Asset Store
Display 1
Free Aspect
Scale
1x
Maximize On Play
Mute Audio
Stats
Gizmos

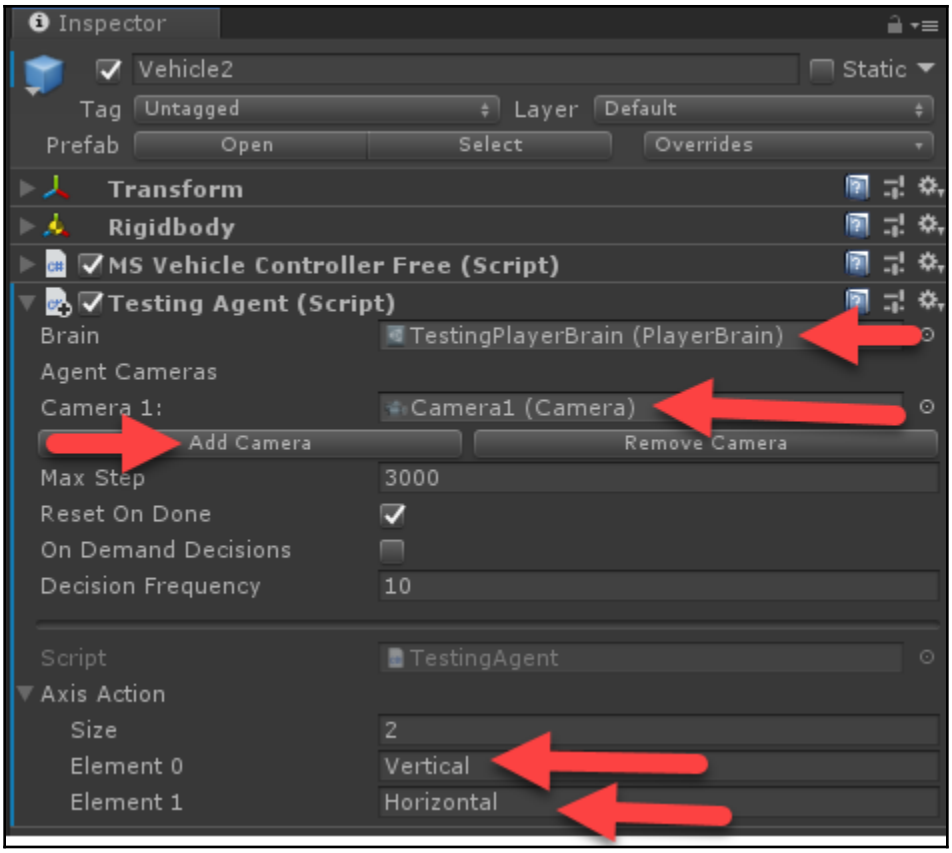

Exporting package
Items to Export
ML-Agents
Editor
AgentEditor.cs
BrainEditor.cs
BrainParametersDrawer.cs
BroadcastHubDrawer.cs
DemonstrationDrawer.cs
DemonstrationImporter.cs
HeuristicBrainEditor.cs
LearningBrainEditor.cs
PlayerBrainEditor.cs
ResetParameterDrawer.cs
Tests
DemonstrationTests.cs
EditModeTestActionMasker.cs
EditModeTestInternalBrainTensorApplier.cs
EditModeTestInternalBrainTensorGenerator.cs
MLAgentsEditModeTest.cs
MultinomialTest.cs
RandomNormalTest.cs
UtilitiesTests.cs
Examples
3DBall
Brains
3DBallHardLearning.asset
3DBallHardPlayer.asset
3DBallHeuristic.asset
3DBallLearning.asset
All
Include dependencies
Export...

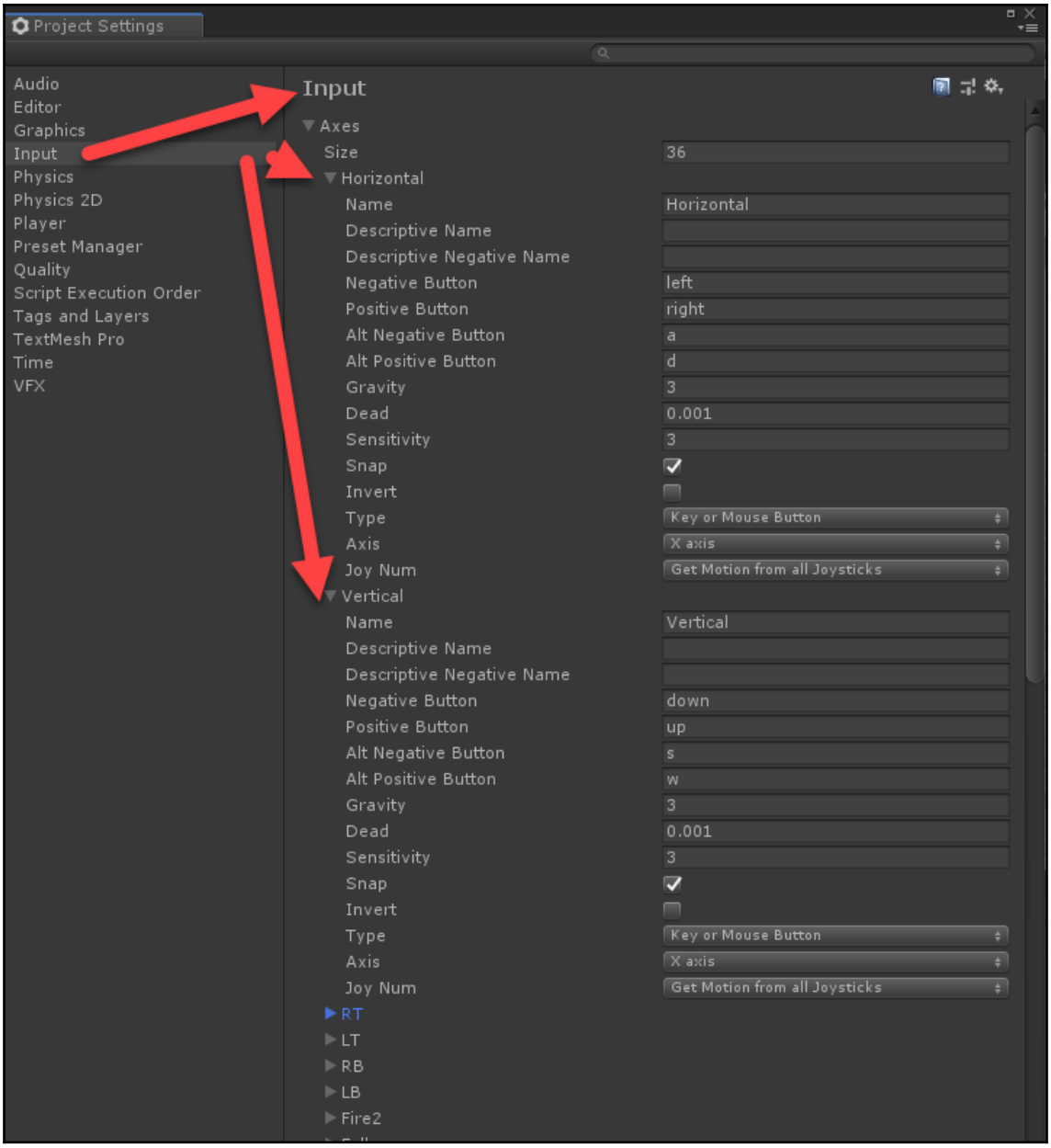

Project
Console
Create
Favorites
All In Progress
All Modified
All Conflicts
All Excluded
All Materials
All Models
All Prefabs
Assets
HoDLG
Brains
Prefabs
Scripts
ML-Agents
MSVehicleSystem(FreeVersion)
Scenes
Packages
Assets > HoDLG >
Brains
Prefabs
Scripts

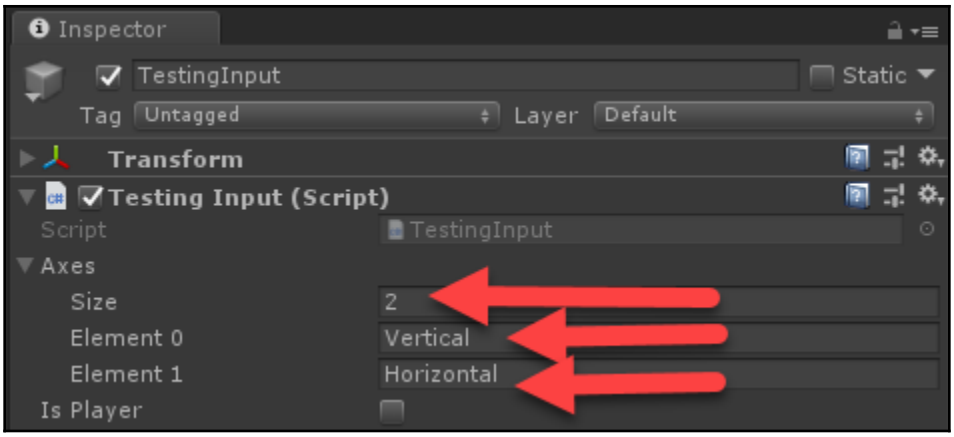

Collab
Account
Layers
Layout
Inspector
Gizmos
All
Persp
goal
Static
Tag goal
Layer Default
Prefab
Open
Select
Overrides
Transform
Position
Rotation
Scale
Cube (Mesh Filter)
Mesh
Cube
Mesh Renderer
Materials
Size
Element 0
v46
Blend Probes
None (Transform)
On
Per Object Motion
Box Collider
Edit Collider
None (Physic Material)
Select Material
Assets
Scene
v46
v47
v48
v310
v46
Material
FreeVersion)/3DModels/Vel

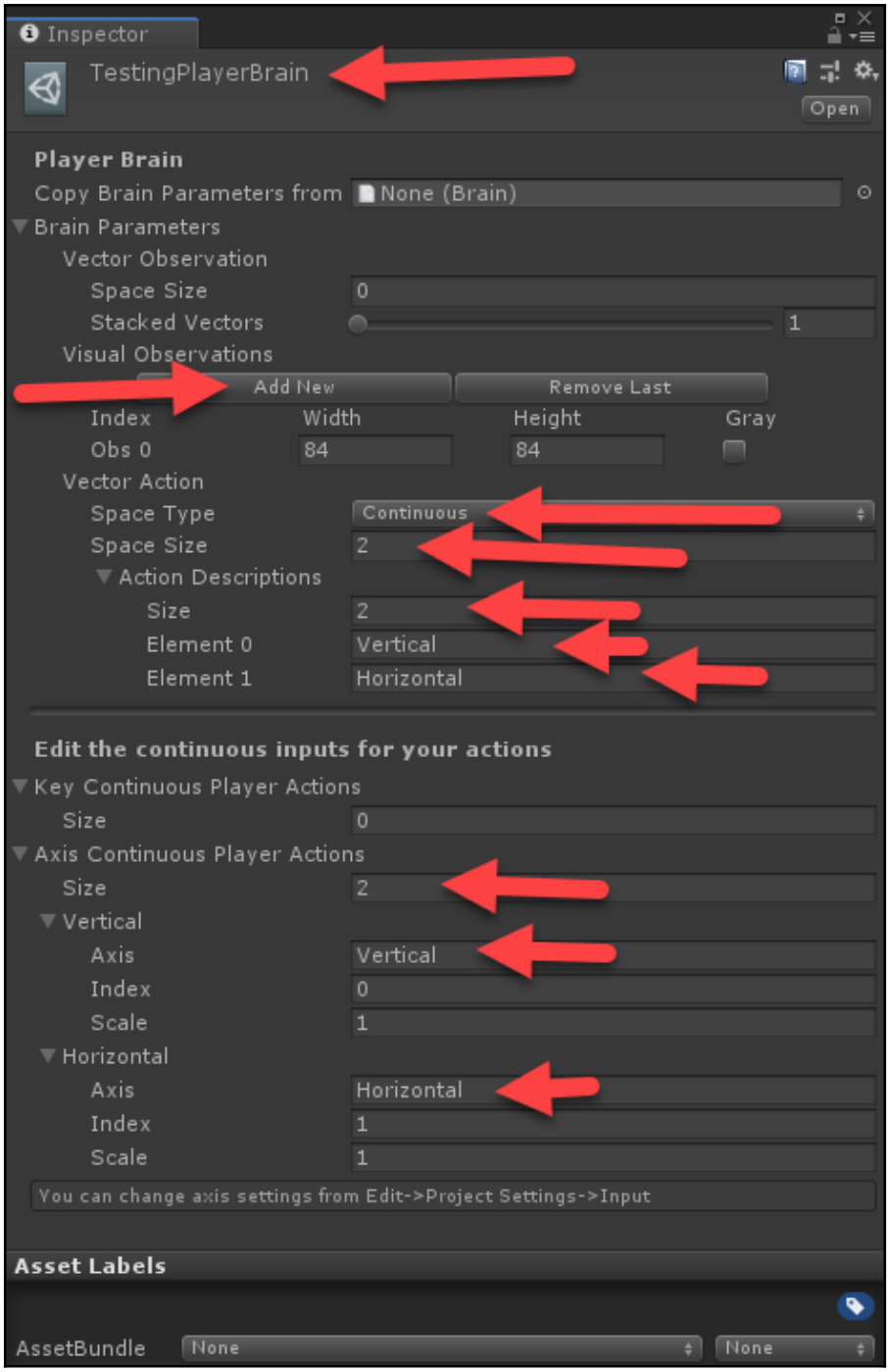

Inspector
TestingAcademy
Static
Tag
Untagged
Layer
Default
Transform
Position
Rotation
Scale
Testing Academy (Script)
Script
TestingAcademy
Broadcast Hub
Add New
Remove Last
Brains
Control
TestingLearningBrain (LearningBrain)
Max Steps
3000
Training Configuration
Inference Configuration
Width
1280
Height
720
Quality Level
Time Scale
Target Frame Rate
60
Reset Parameters
Add New
Goal
goal
Num Goals
3
Goal Size
Goal Center
X 85
Y 100
Z -37
Agents
Add Component

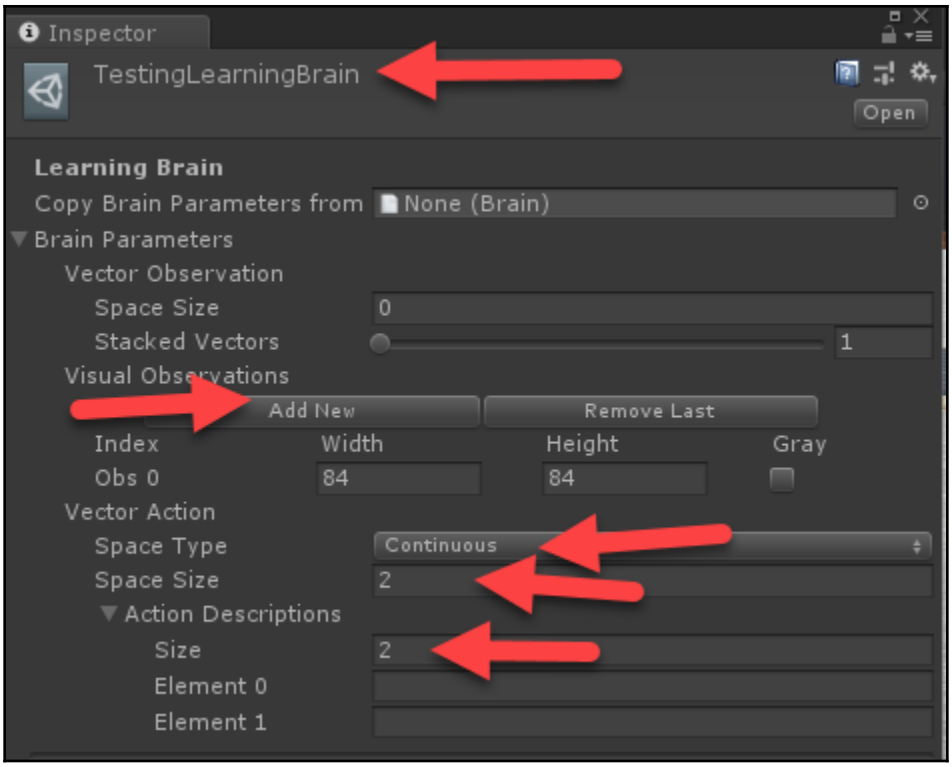

Scene
Game
Asset Store
Shaded
2D
Gizmos
Camera Preview
Camera Preview
Camera Preview
Camera Preview
Camera Preview

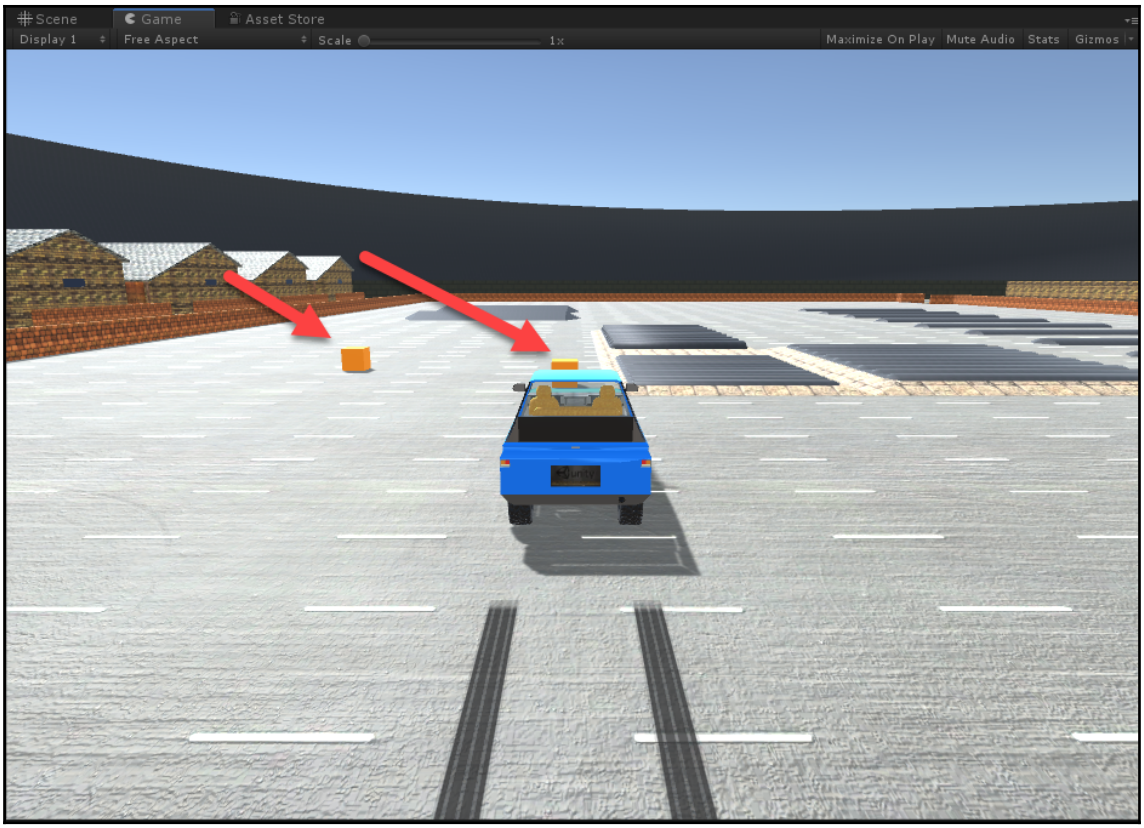

Inspector
Vehicle2
Static
Tag
Untagged
Layer
Default
Prefab
Open
Select
Overrides
Transform
Rigidbody
MS Vehicle Controller Free (Script)
Testing Agent (Script)
Brain
TestingPlayerBrain (PlayerBrain)
Agent Cameras
Camera 1:
Camera1 (Camera)
Add Camera
Remove Camera
Max Step
3000
Reset On Done
On Demand Decisions
Decision Frequency
10
Script
TestingAgent
Axis Action
Size
2
Element 0
Vertical
Element 1
Horizontal

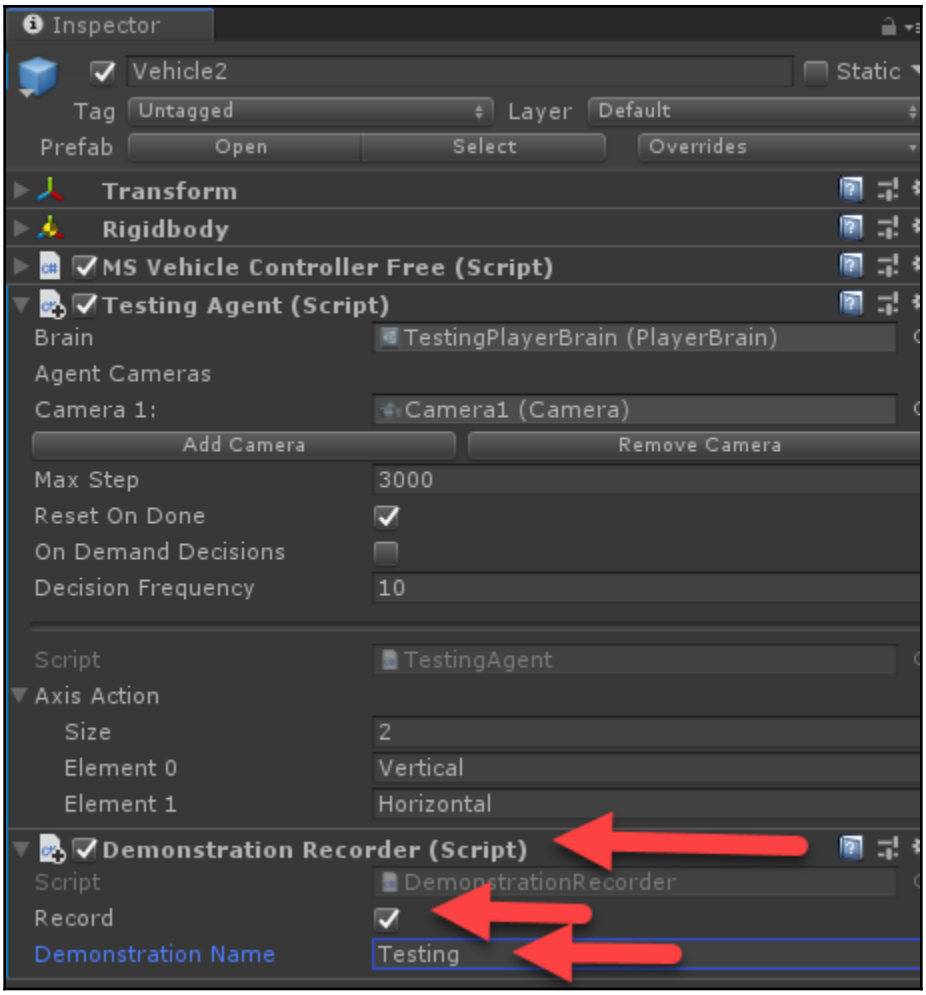

Project Settings
Audio
Editor
Graphics
Input
Physics
Physics 2D
Player
Preset Manager
Quality
Script Execution Order
Tags and Layers
TextMesh Pro
Time
VFX
Input
Axes
Size 36
Horizontal
Name Horizontal
Descriptive Name
Descriptive Negative Name
Negative Button left
Positive Button right
Alt Negative Button a
Alt Positive Button d
Gravity 3
Dead 0.001
Sensitivity 3
Snap
Invert
Type Key or Mouse Button
Axis X axis
Joy Num Get Motion from all Joysticks
Vertical
Name Vertical
Descriptive Name
Descriptive Negative Name
Negative Button down
Positive Button up
Alt Negative Button s
Alt Positive Button w
Gravity 3
Dead 0.001
Sensitivity 3
Snap
Invert
Type Key or Mouse Button
Axis X axis
Joy Num Get Motion from all Joysticks
RT
LT
RB
LB
Fire2

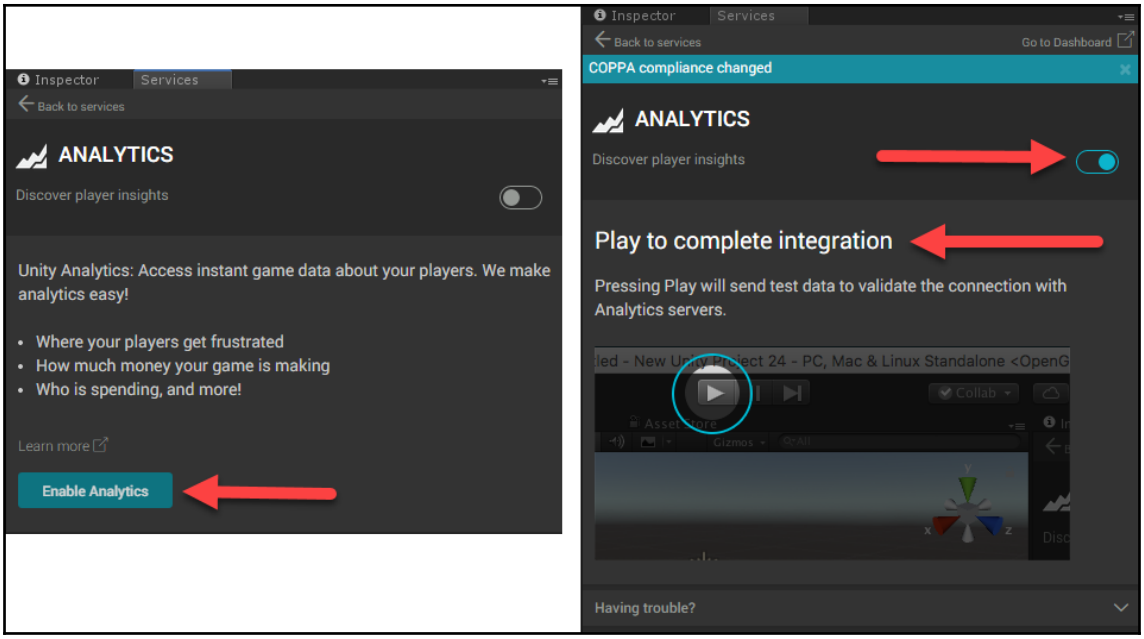

Inspector
TestingInput
Static
Tag
Untagged
Layer
Default
Transform
Testing Input (Script)
Script
TestingInput
Axes
Size
2
Element 0
Vertical
Element 1
Horizontal
Is Player

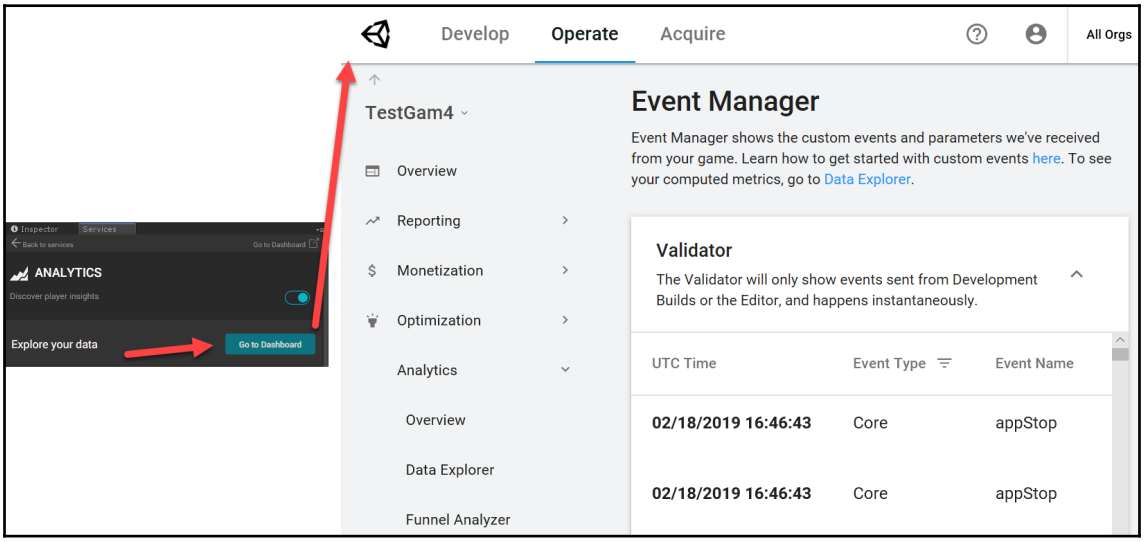

Inspector
TestingPlayerBrain
Open
Player Brain
Copy Brain Parameters from
None (Brain)
Brain Parameters
Vector Observation
Space Size
0
Stacked Vectors
1
Visual Observations
Add New
Remove Last
Index
Width
Height
Gray
Obs 0
84
84
Vector Action
Space Type
Continuous
Space Size
2
Action Descriptions
Size
2
Element 0
Vertical
Element 1
Horizontal
Edit the continuous inputs for your actions
Key Continuous Player Actions
Size
0
Axis Continuous Player Actions
Size
2
Vertical
Axis
Vertical
Index
0
Scale
1
Horizontal
Axis
Horizontal
Index
1
Scale
1
You can change axis settings from Edit->Project Settings->Input
Asset Labels
AssetBundle
None
None

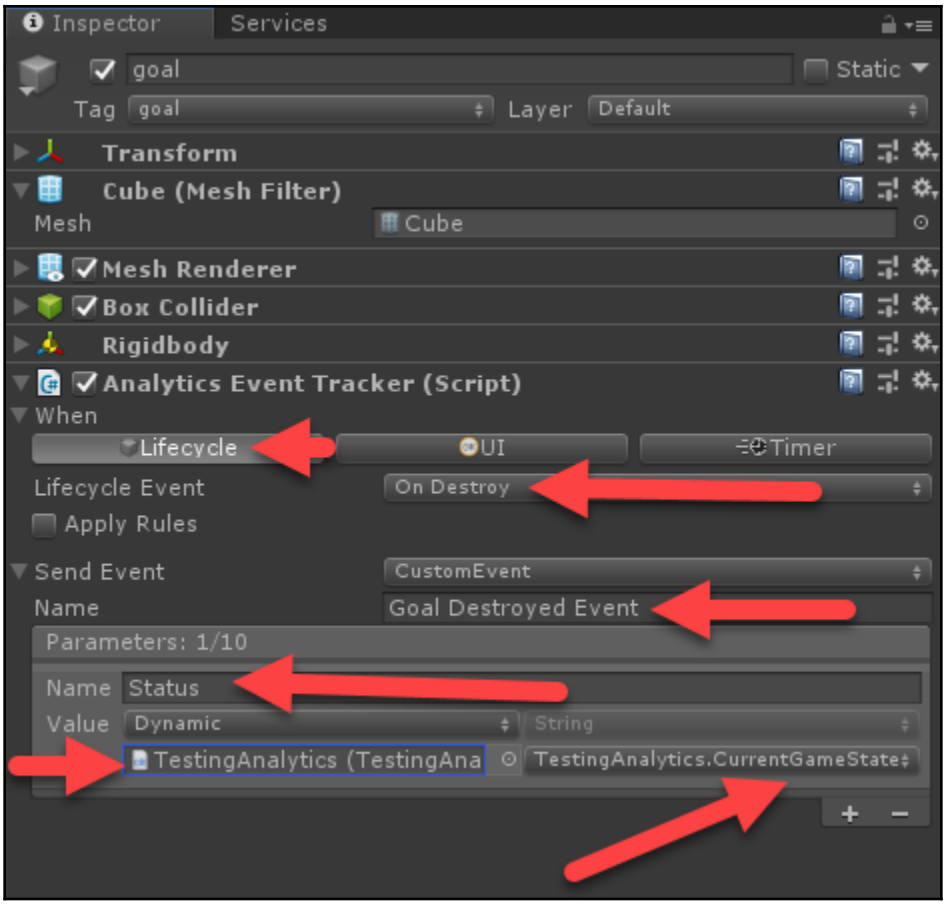
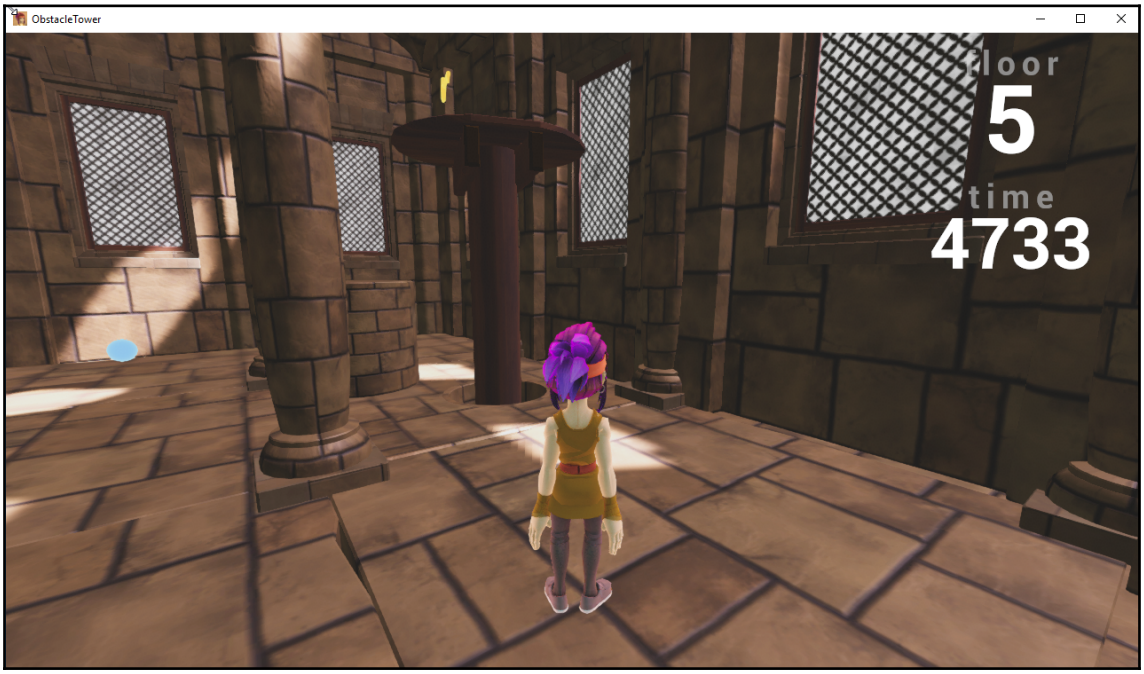

Inspector
TestingLearningBrain
Open
Learning Brain
Copy Brain Parameters from
None (Brain)
Brain Parameters
Vector Observation
Space Size
0
Stacked Vectors
1
Visual Observations
Add New
Remove Last
Index
Width
Height
Gray
Obs 0
84
84
Vector Action
Space Type
Continuous
Space Size
2
Action Descriptions
Size
2
Element 0
Element 1


Scene
Game
Asset Store
Display 1
Free Aspect
Scale
1x
Maximize On Play
Mute Audio
Stats
Gizmos


Inspector
Vehicle2
Static
Tag
Untagged
Layer
Default
Prefab
Open
Select
Overrides
Transform
Rigidbody
MS Vehicle Controller Free (Script)
Testing Agent (Script)
Brain
TestingPlayerBrain (PlayerBrain)
Agent Cameras
Camera 1:
Camera1 (Camera)
Add Camera
Remove Camera
Max Step
3000
Reset On Done
On Demand Decisions
Decision Frequency
10
Script
TestingAgent
Axis Action
Size
2
Element 0
Vertical
Element 1
Horizontal
Demonstration Recorder (Script)
Script
DemonstrationRecorder
Record
Demonstration Name
Testing


Inspector
Services
Back to services
ANALYTICS
Discover player insights
Unity Analytics: Access instant game data about your players. We make analytics easy!
Where your players get frustrated
How much money your game is making
Who is spending, and more!
Learn more
Enable Analytics
Inspector
Services
Back to services
Go to Dashboard
COPPA compliance changed
ANALYTICS
Discover player insights
Play to complete integration
Pressing Play will send test data to validate the connection with Analytics servers.
Having trouble?


Develop
Operate
Acquire
All Orgs
TestGam4
Overview
Reporting
Monetization
Optimization
Analytics
Overview
Data Explorer
Funnel Analyzer
Event Manager
Event Manager shows the custom events and parameters we've received from your game. Learn how to get started with custom events here. To see your computed metrics, go to Data Explorer.
Validator
The Validator will only show events sent from Development Builds or the Editor, and happens instantaneously.
UTC Time
Event Type
Event Name
02/18/2019 16:46:43
Core
appStop
02/18/2019 16:46:43
Core
appStop
ANALYTICS
Discover player insights
Explore your data
Go to Dashboard


Inspector
Services
goal
Static
Tag goal
Layer Default
Transform
Cube (Mesh Filter)
Mesh Cube
Mesh Renderer
Box Collider
Rigidbody
Analytics Event Tracker (Script)
When
Lifecycle
UI
Timer
Lifecycle Event
On Destroy
Apply Rules
Send Event
CustomEvent
Name
Goal Destroyed Event
Parameters: 1/10
Name Status
Value Dynamic
String
TestingAnalytics (TestingAna
TestingAnalytics.CurrentGameState

Chapter 13: Obstacle Tower Challenge and Beyond