# Applied Artificial Intelligence
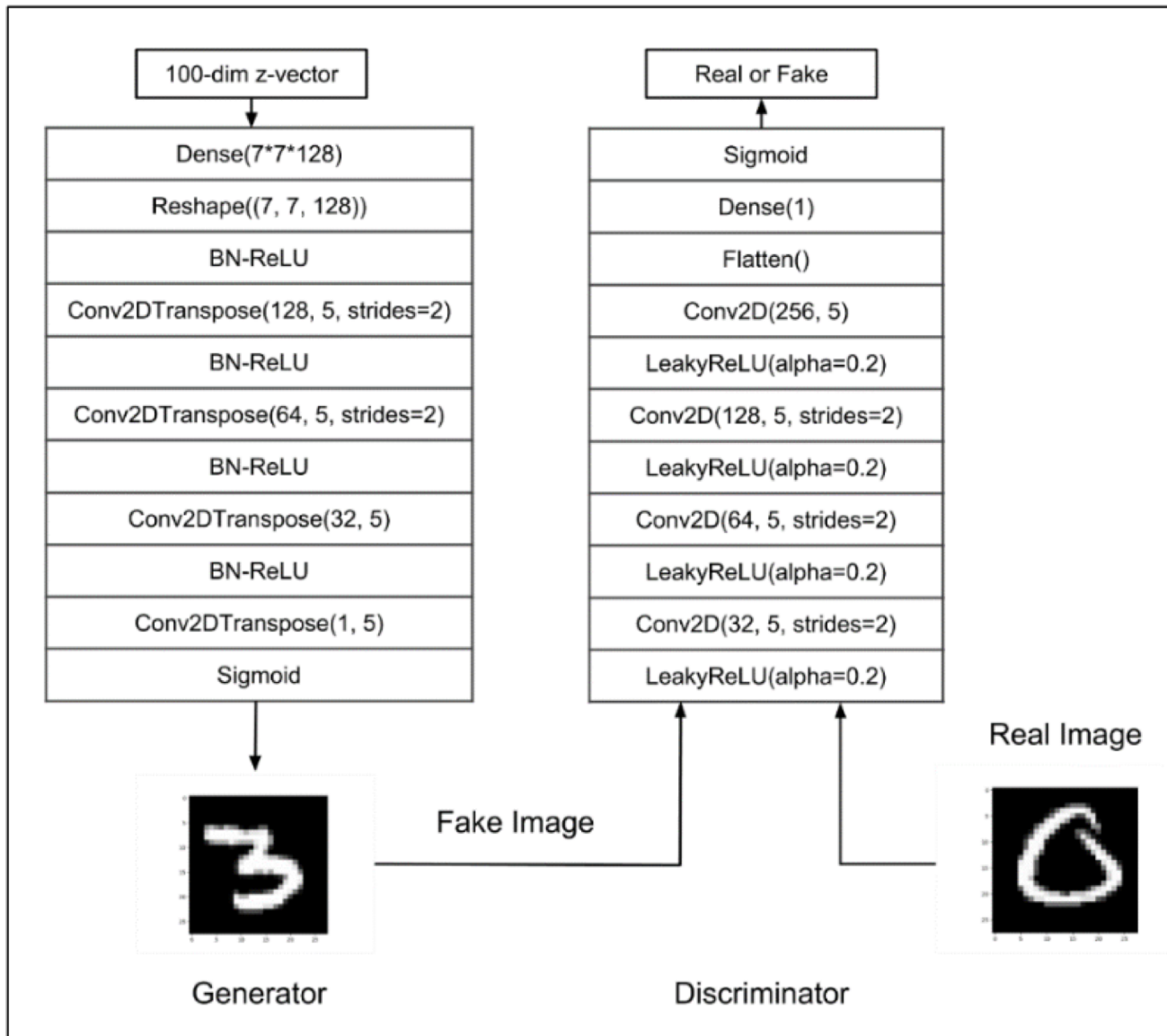
## Session 27: GANs III
## Reinforcement Learning I
### Fall 2018
### NC State University
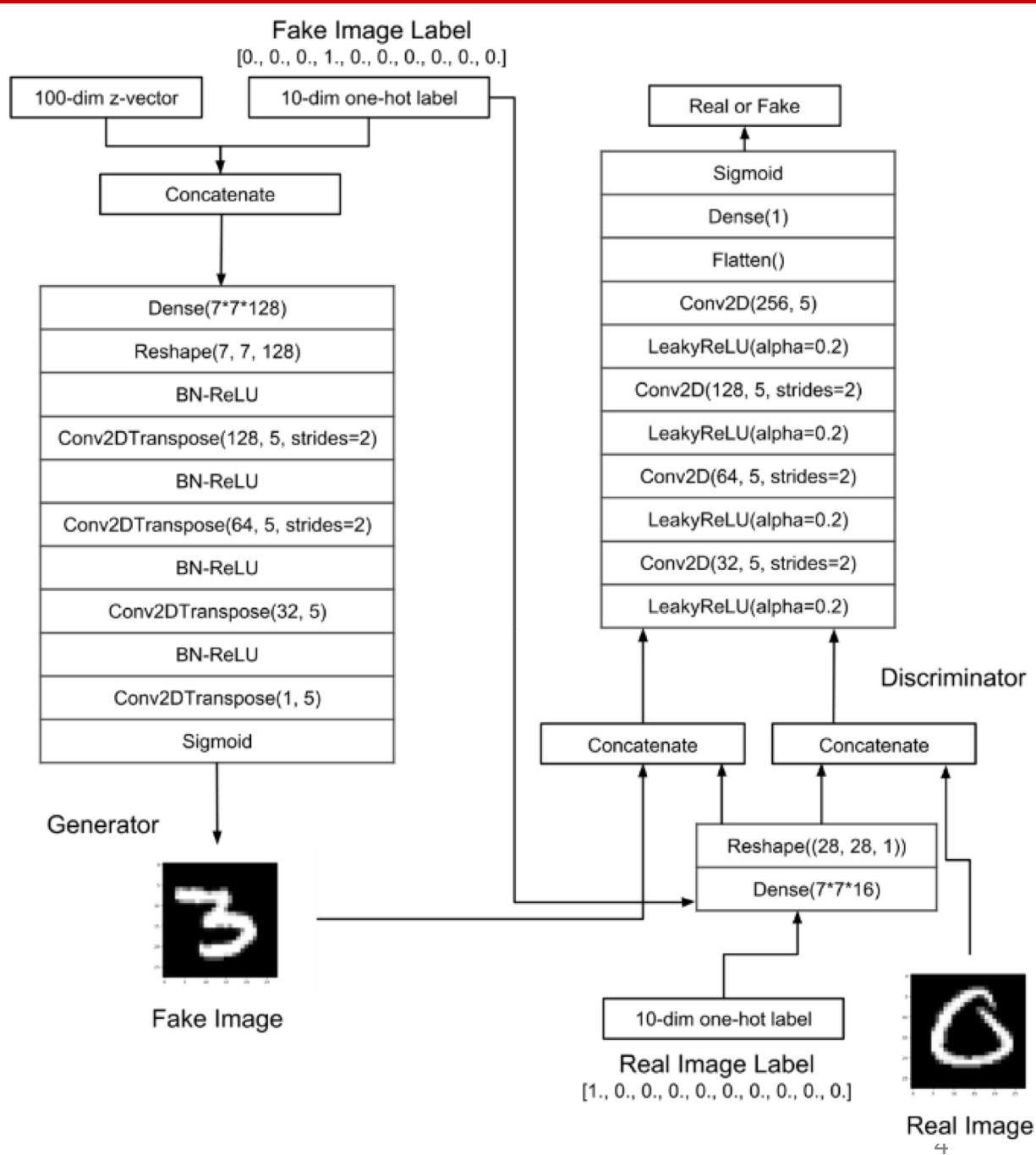Lecturer: Dr. Behnam Kia
Course Website: https://appliedai.wordpress.ncsu.edu/

# Deep Convolutional GANs



Picture from: Advanced Deep Learning with Keras, Rowel Atienza

https://www.youtube.com/watch?v=G06dEcZ-QTg&feature=youtu.be

# Conditional GAN



Fake Image Label
[0., 0., 0., 1., 0., 0., 0., 0., 0., 0.]

| 100-dim z-vector | 10-dim one-hot label |

Real or Fake

Concatenate

**Generator**

| Dense(7*7*128) |
| Reshape(7, 7, 128) |
| BN-ReLU |
| Conv2DTranspose(128, 5, strides=2) |
| BN-ReLU |
| Conv2DTranspose(64, 5, strides=2) |
| BN-ReLU |
| Conv2DTranspose(32, 5) |
| BN-ReLU |
| Conv2DTranspose(1, 5) |
| Sigmoid |

Fake Image

**Discriminator**

| Sigmoid |
| Dense(1) |
| Flatten() |
| Conv2D(256, 5) |
| LeakyReLU(alpha=0.2) |
| Conv2D(128, 5, strides=2) |
| LeakyReLU(alpha=0.2) |
| Conv2D(64, 5, strides=2) |
| LeakyReLU(alpha=0.2) |
| Conv2D(32, 5, strides=2) |
| LeakyReLU(alpha=0.2) |

Concatenate   Concatenate

| Reshape((28, 28, 1)) |
| Dense(7*7*16) |

10-dim one-hot label

Real Image Label
[1., 0., 0., 0., 0., 0., 0., 0., 0., 0.]

Real Image

Picture from: Advanced Deep Learning with Keras, Rowel Atienza

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- https://github.com/NVIDIA/vid2vid

# Reinforcement Learning

# Supervised Learning

# Supervised Learning

- Automatically build a function that maps inputs to the outputs, <u>given a set of example pairs</u>.

# Unsupervised Learning

- No labels assigned to the data. The goal is to learn the hidden structure of the data, e.g. clustering, etc.

# GAN is Supervised or Unsupervised?

- Although the discriminator is trained using a supervised method, but the generator itself is unsupervised.

- GAN tries to learn how the data looks like and estimates its pdf, and then generators synthetic data.

# **GAN is Supervised or Unsupervised?**

# Reinforcement Learning

- Reinforcement Learning (RL): Learning Optimal Behavior in Complex Environment
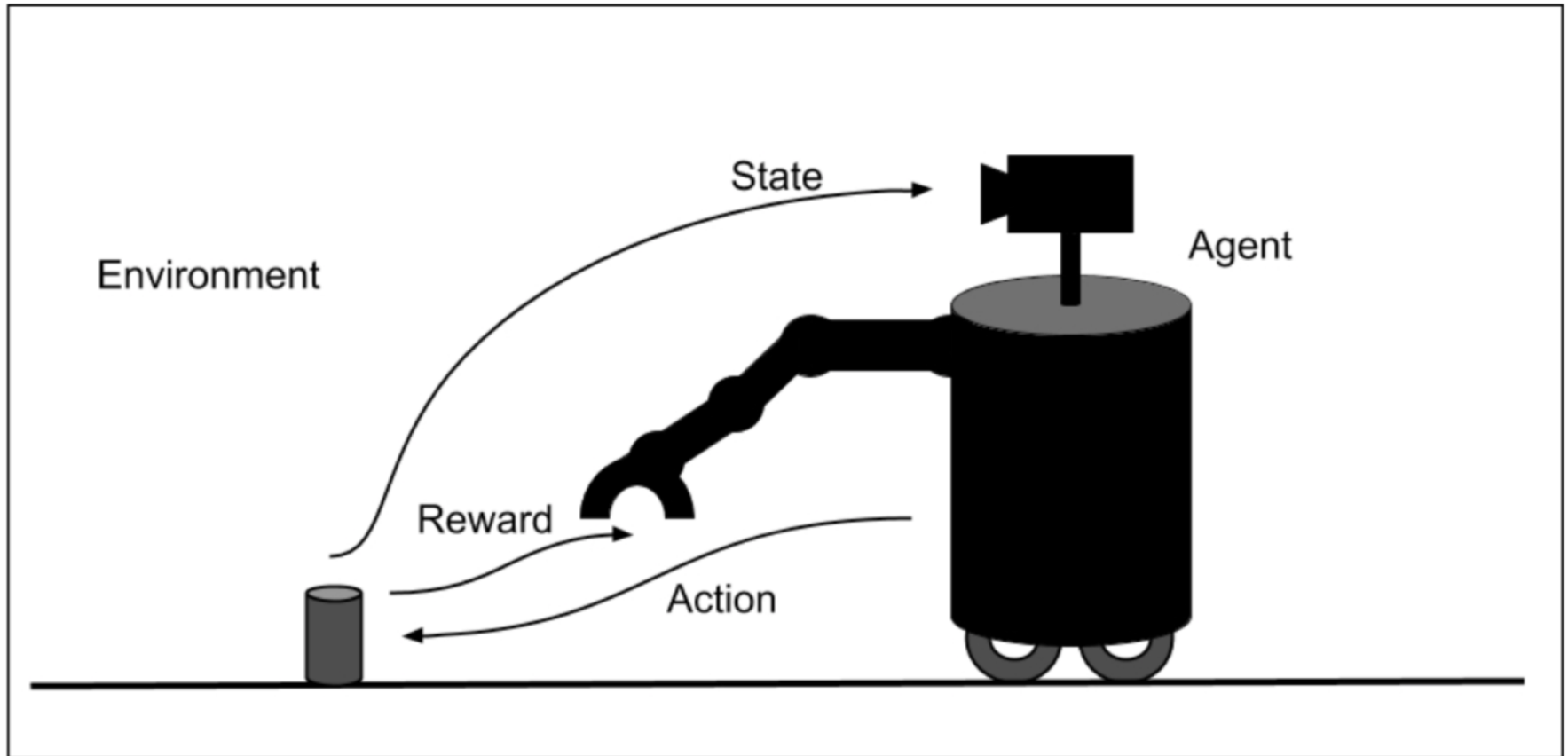
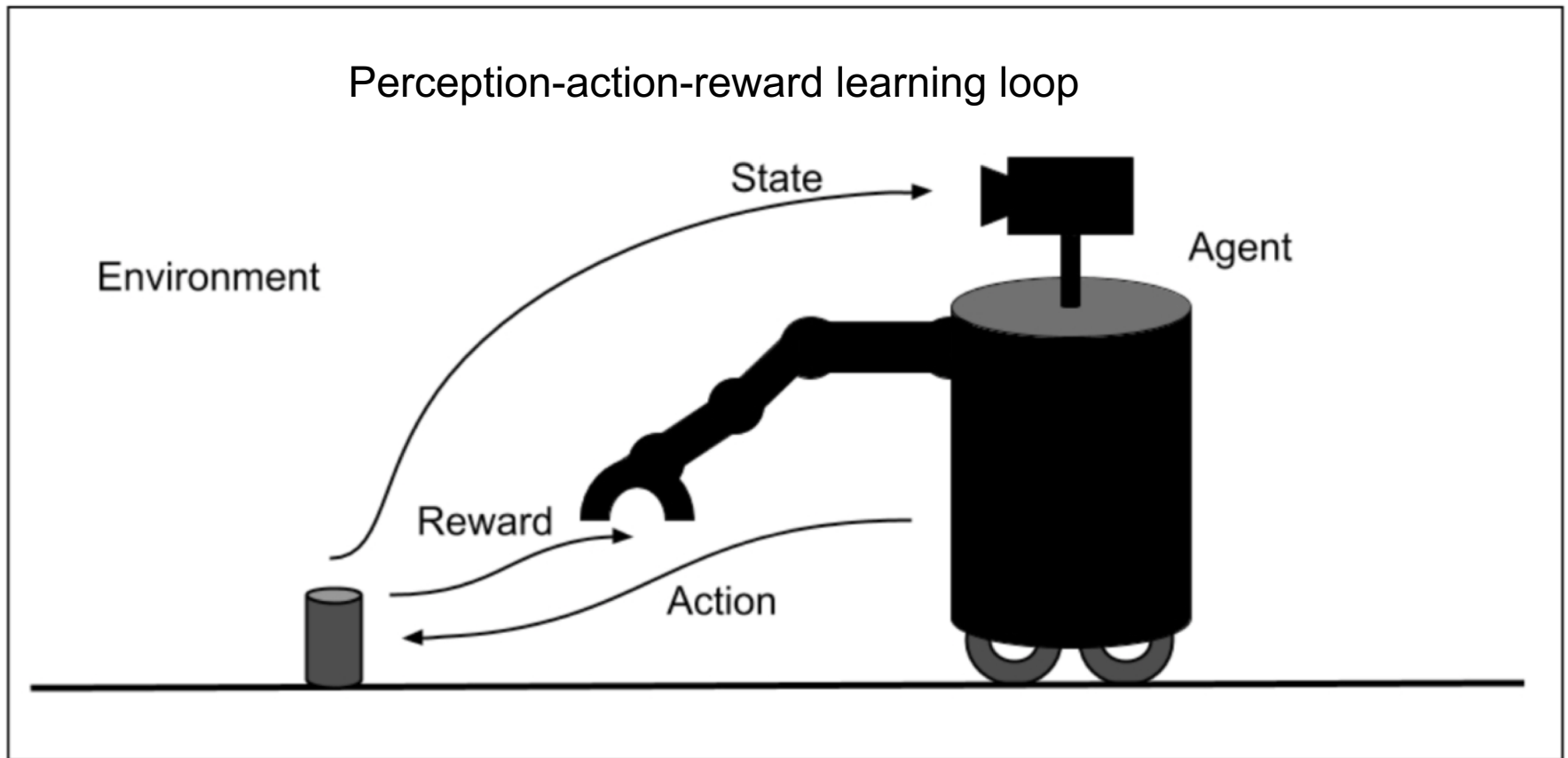**Unsupervised Learning**          **Reinforcement Learning**          **Supervised Learning**
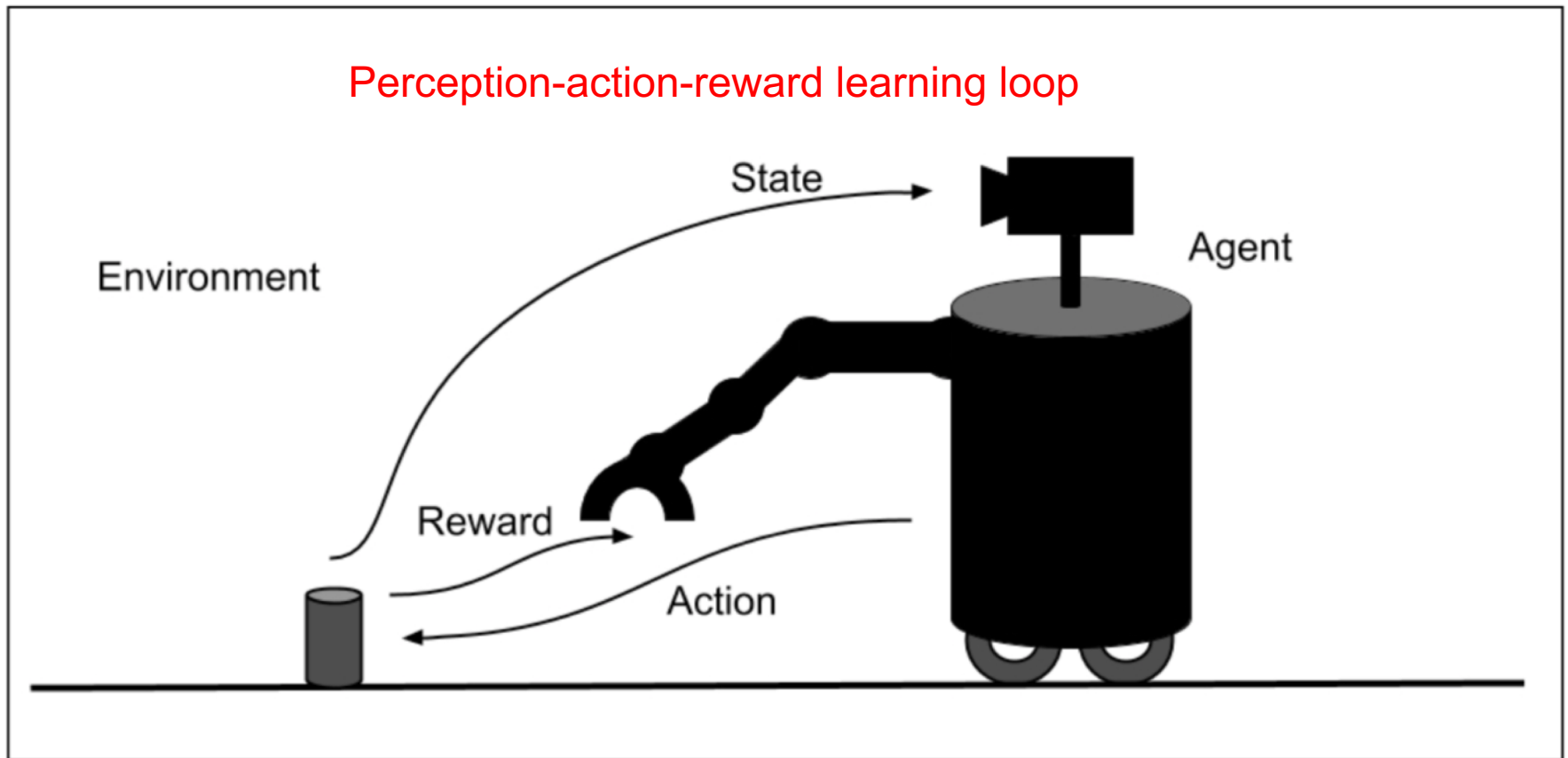
*Availability of labels and performance feedback*

# Reinforcement Learning



Picture from Advanced Deep Learning with Keras

# Reinforcement Learning

Perception-action-reward learning loop



Picture from Advanced Deep Learning with Keras

# Reinforcement Learning



Perception-action-reward learning loop

Picture from Advanced Deep Learning with Keras

# Reinforcement Learning

Perception-action-reward learning loop

Goal: To learn a policy to take actions that maximizes rewards



Picture from Advanced Deep Learning with Keras