Machine Learning

RAJESH SHARMA
Walt Disney Animation Studios

7

Machine Learning

Rajesh Sharma

Today - Last Class!

- Guest: Andrew Glassner
- Reinforcement Learning
- Wrap up and where to go from here

Hands-on

- ★ Log in to your google drive
- ★ Make a shortcut to: `https://bit.ly/3oKCVCh`
- ★ Make a copy of:
  - `AG-Nim.ipynb`

Andrew Glassner

Sr. Research Scientist

Senior Research Scientist

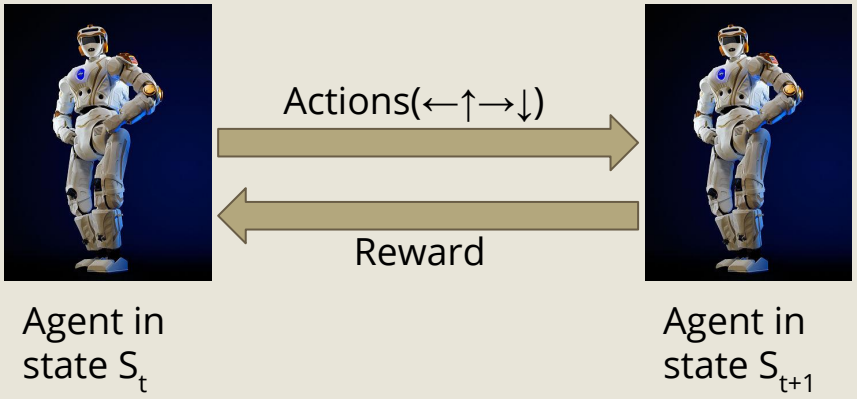
Weta Digital

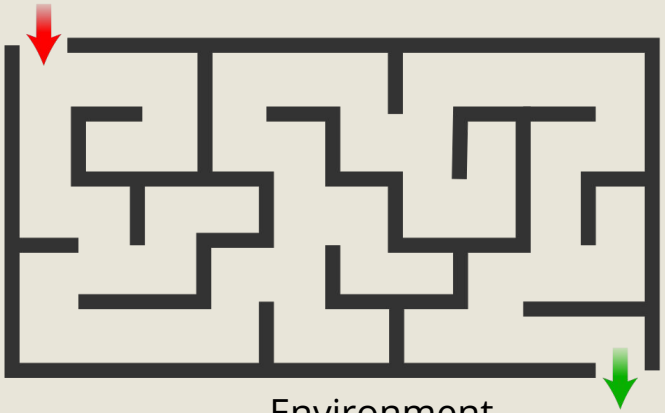
Andrew Glassner is a Senior Research Scientist at visual effects company Weta Digital. He has carried out research at the NYIT Computer Graphics Lab, Case Western Reserve University, the IBM TJ Watson Research Lab, the Delft University of Technology, Bell Communications Research, Xerox PARC, and Microsoft Research. A prolific writer and educator, well known for the *Graphics Gems* series, *An Introduction to Ray Tracing, Principles of Digital Image Synthesis* and *Andrew Glassner's Notebook*. His latest book, *Deep Learning: a Visual Approach* is now available.

Today:

Reinforcement Learning:

Environment, states, actions, rewards





Goal: Maximize Total Reward

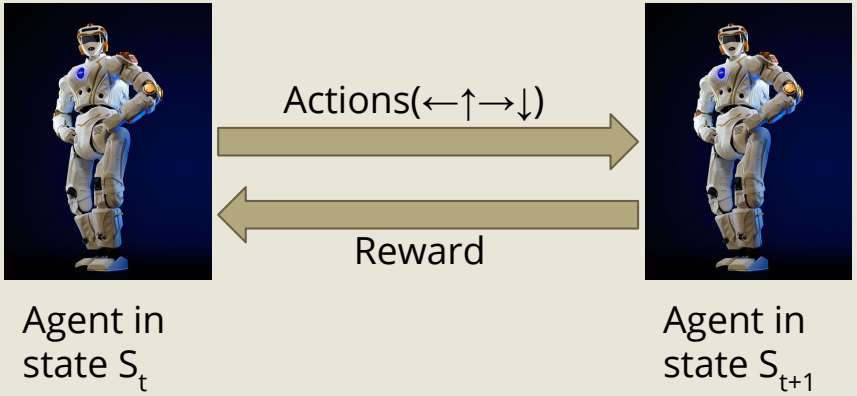
Key Pieces:

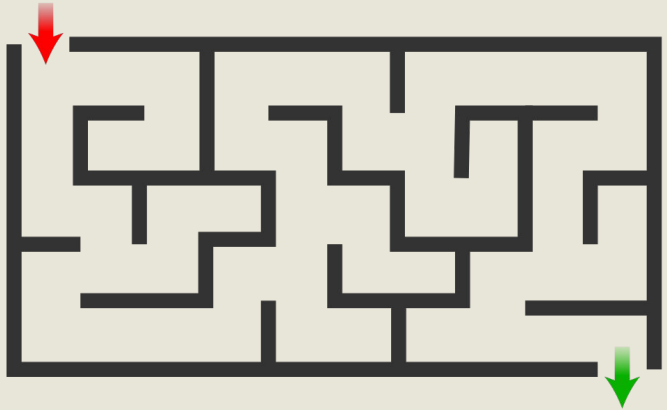
Actions & States

Policy for choosing next action

Model of environment

Reward at each step





Goal: Maximize Total Reward

Environment

Thank you to the guests!

Thank you to ACM SIGGRAPH!

Pol Jeremias-Vila : SIGGRAPH 2021 Chair

Tomasz Bednarz: Frontiers Program Chair

Alex Bryant: Student Volunteers Chair

Tim Hendrickson: Digital Marketing Manager

Student Volunteers:
Rogelio, Trinity, Aurora, Emily, Hunter & Kendra

SIGGRAPH 2021

Summary

-- Basics: data, regression, UAT, no free-lunch
-- Fully Connected: experiments, final layer
-- CNN: building block for image-based training
-- RNN, LTSM, Transformer: time series, language, text
-- Unet, resNet: CNN-like with better detail transfer
-- Variational AutoEncoder: Generative:(mean,variance)
-- Transfer Learning: mt-cnn, facenet
-- GAN: Generative: direct sample
-- Reinforcement Learning: env, states, actions, rewards

Summary (Theory)

- We have some data (X) from an unknown distribution (D).
- We try to find a known distribution (P) posterior that is as close to (D) as possible.
- Then we can sample from this known distribution to find the probability of a new sample.
- Bayesian inference

- **Regression**: take log of the posterior...squared error
- **Classification**: softmax of the logs -- cross-entropy
- **Variational Autoencoder**: Tries to map D to a Gaussian Distribution
- **GAN**: tries to generate a sample from noise so that it belongs as close as possible to D

Summary (Practice)

-- Data: Lots of it, augmentation, un-biased
-- Bias vs Variance: Overtraining, Undertraining
-- Hyperparameters: layers, nodes, optimizer, L-Rate
-- Loss function: logits (log-likelihood), L2, L1
-- Training: epochs, batches, tfds, plotting
-- Distributions: you are trying to find a sample
-- Work like a scientist:
    Hypothesis, experiment, observe, record, change:
    Repeat

Summary (things we did not cover)

-- Cloud-based: Training and Deployment, ML-ops
-- Local: clusters, machines, environment
-- Tensorboard: for logging, visualizations, checkpoints
-- Intermediate layer visualization
-- Other methods: Random Forests, XGBoost
-- More theory

Local Install (Linux/Mac)

```
# In Colab (after you have imported everything you need)
!pip freeze > requirements.txt
# On your machine
%mkdir ~/myml
%cd ~/myml

# copy the requirements.txt file from the Colab directory to ~/myml

# create a python3 virtual environment
%python3 -mvenv --system-site-packages mlenv

# activate the virtual environment
source mlenv/bin/activate

# upgrade the installer
pip install --upgrade pip

# Install all the software specified in requirements.txt
pip install -r requirements.txt

# test it out:
# this should point to the python in the virtual env
which python
```

Where to go from here

Deep Learning:
https://www.deeplearningbook.org and some excellent lectures to go along:
https://www.deeplearningbook.org/lecture_slides.html

Deep Learning a Visual Approach by Andrew Glassner:
https://nostarch.com/deep-learning-visual-approach

Statistics:
https://link.springer.com/book/10.1007/978-0-387-21736-9

A roadmap to reading:
https://github.com/floodsung/Deep-Learning-Papers-Reading-Roadmap

More comprehensive list of resources:
https://www.kdnuggets.com/2020/03/24-best-free-books-understand-machine-learning.html

Video Tutorials (3Blue1Brown):
https://www.youtube.com/channel/UCYO_jab_esuFRV4b17AJtAw/videos

Where to go from here

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https://www.deeplearningbook.org/lecture_slides.html

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QUESTIONS?

- Chat
- #xarmalarma
- LinkedIn