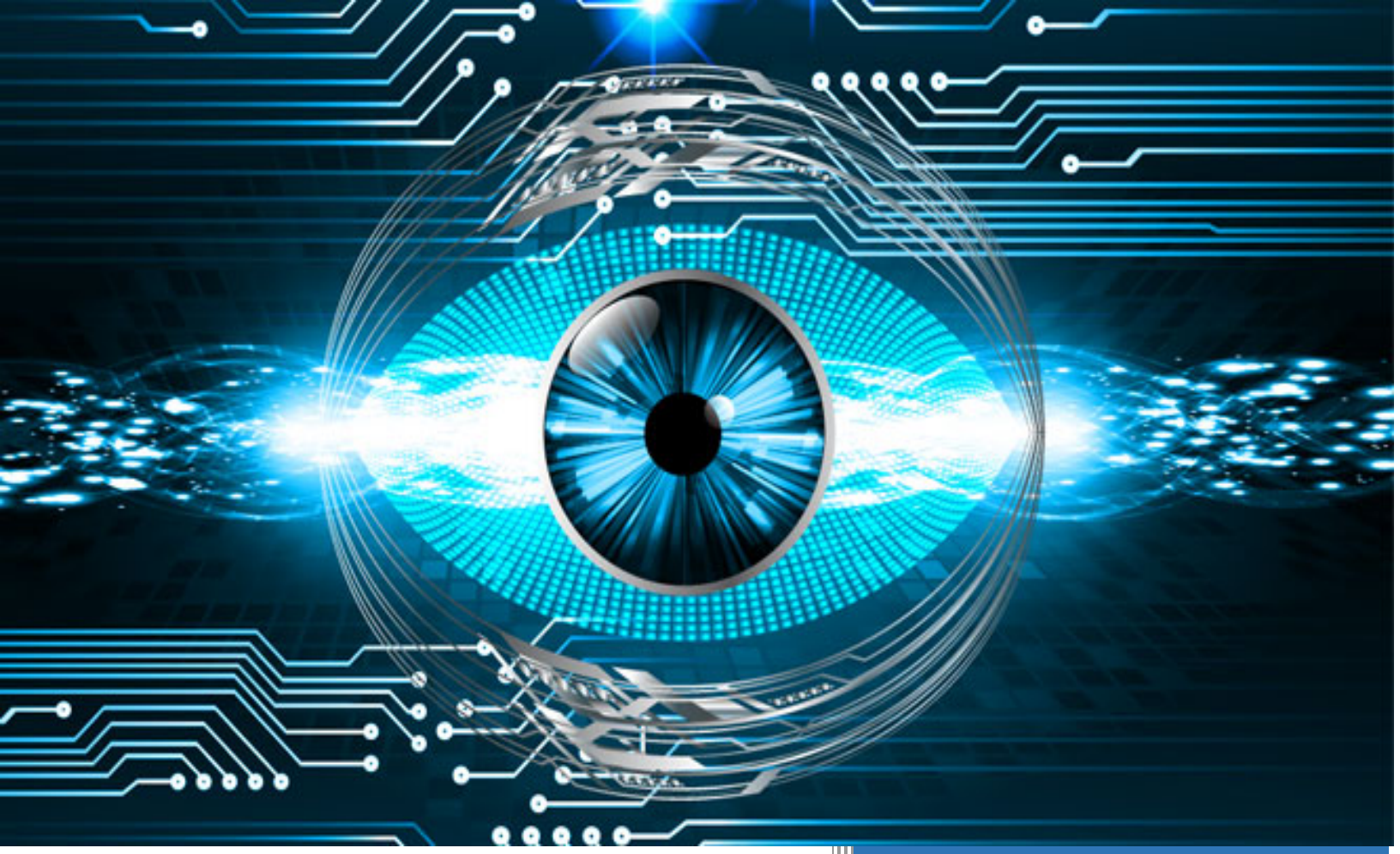


UCF RET Site: Research Experiences in Computer Vision and Crowd Counting & Data Collection Lesson Plan

AP Computer Science Principles

2018

Canone, Christopher R.

AP Computer Science Principles

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RET Site: Research Experiences in Computer Vision and Crowd Counting Lesson Plan

Course: AP Computer Science Principles
Grade Level: 9th – 12th Grade
Suggested Length of Lesson: 2-3 days

Materials/Technology Needed
- Presentation Capability (power point)
- Ability to show python programing
  - **(Extra not necessary)**

Where this Fits
- As an extension activity after students learn about how computers work and how to create and use algorithms. As well as understanding the importance of the collection of Data.

Lesson Objective(s)/Learning Goal(s)
- Students will be able to describe Crowd Counting the utilization of it within "Big Data" and data collection
- Student will understand the importance of Data Collection and where CROWD COUNTING fits into Data
- Students will be able to compare and contrast machine learning methods, AI and Computer Vision applications

Standard(s)/Benchmark(s) Addressed
- *Standards:*
  - ***EK 4.1.1H:*** *Different algorithms can be developed to solve the same problem*
  - ***EK 4.2.3B:*** *A decidable problem is one in which an algorithm can be constructed to answer "yes" or "no" for all inputs*
  - ***EK 4.2.4E:*** *Sometimes, more efficient algorithms are more complex*

Standards for Mathematical Practice

Evidence of Learning (Assessment Plan)
- Students will be able to work in groups and collaborate in a humanistic approach of creating a counting algorithm.

Instructional Strategies
- *Monitoring Progress*
  - Reflection/Response class questioning and written reflections
- *Compare and Contrast*
  - Different machine learning algorithms
- *Graphing Organizers*
  - Charts and diagrams explaining algorithms

Description of Lesson Activity/Experiences:

Pre-Work:
- "DATA Collection Project"
  - **Your assignment is to collect images of crowds or groups of people (preferably 25 people or better).**
  - ***Images should be:***
    - *Best Quality*
    - *50-100 or more*
    - *Consistent (if possible Location, day, time)*
    - *Minimum 7 Images*

Day 1
- *Go through attached presentation: Computer Vision UCF/RET*
  - Computer Vision
  - How Computers see things?
  - Scene Classification
  - Edge Detection
  - A.I.
  - Neural Network Video (Homework/Edpuzzle)

Day 2

- *Go through attached presentation: Crowd Counting (NEARPOD)*
  - *What is Big Data?*
  - *The Value of Big Data?*
  - *What is Big Data being used for?*
  - *What it Crowd Counting?*
  - *UCF's Research*
  - *Real Life Applications*
    - *Data collection, Security, Attendance large demonstrations, Targeting, etc*
- **Build teams**. Go thru activity with images.
  - *Review group answers*
    - Based on the image given where do you feel the image was taken?
    - Based on the image, How many people were at the event?
    - How did you as a team come up with that number? Was there a process/algorithm used? What was it?
    - Why do you think that number is important to know?
  - ***Discuss group counting Algorithm***
    - Jacob's Method Overview
  - *Data/Picture Collection project*
    - Pictures collected by students – "Data Collection" Project
    - Utilize UCF Site: www.bit.ly/ucfcrowdcounting
      - What were the details of the images taken?
      - Based on your images, Use website to determine how many people were in each image.
      - What is a good evaluation and description of the images and data that you have collected
- **Wrap up discussion.**

Day 3 & 4:

- *EXPLORE TASK Practice:*
  - ***Pick a UCF Research Project from*** ***http://crcv.ucf.edu/research***
  - **Create a 1 page write up. Answer these questions:**
    - What is the purpose or function of this research?
    - How does this "research" impact society, the economy, or culture?
    - Describe how the "research" are beneficial AND how they may be harmful?

Recommended Assessment(s) and Steps

- Have students fill out Worksheet as a group and check algorithms with other groups and compare to the computer algorithms.
- Have students as individuals fill out Worksheets, reflecting on the set of pictures collected during "Data Collecting" project.
  - Don't forget to make them explain their answers as this will what makes them and rest of the class think. May also create disagreement and discussion.

List of Materials/Resources Used

- Worksheet – 2 pages, Image worksheet and counting
- PowerPoint –

Important Vocabulary

Term	Definition
Algorithm	*A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.*
Artificial Intelligence	*The theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.*
Big Data	*A term for datasets so large or complex that traditional data processing applications are inadequate.*
Boosting	*A machine learning ensemble meta-algorithm for primarily reducing bias, and also variance in supervised learning, and a family of machine learning algorithms which convert weak learners to strong ones.*
Machine Learning	*A type of artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed.*
Crowd Counting	A technique used to count or estimate the number of people in a crowd***.***
Neural Network	*A computer system modeled on the human brain and nervous system.*
Supervised Learning (in terms of computers)	*Is the **machine learning** task of inferring a function from labeled **training** data.*
Unsupervised Learning	*A learning techniques that group instances without a pre-specified dependent attribute. Clustering algorithms are usually unsupervised.*

References

[Flex Box]. (2017, January 4). NVIDIA CES 2017 Keynote. Retrieved from

https://youtu.be/jmY2LXy-hXU

Acknowledgements

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