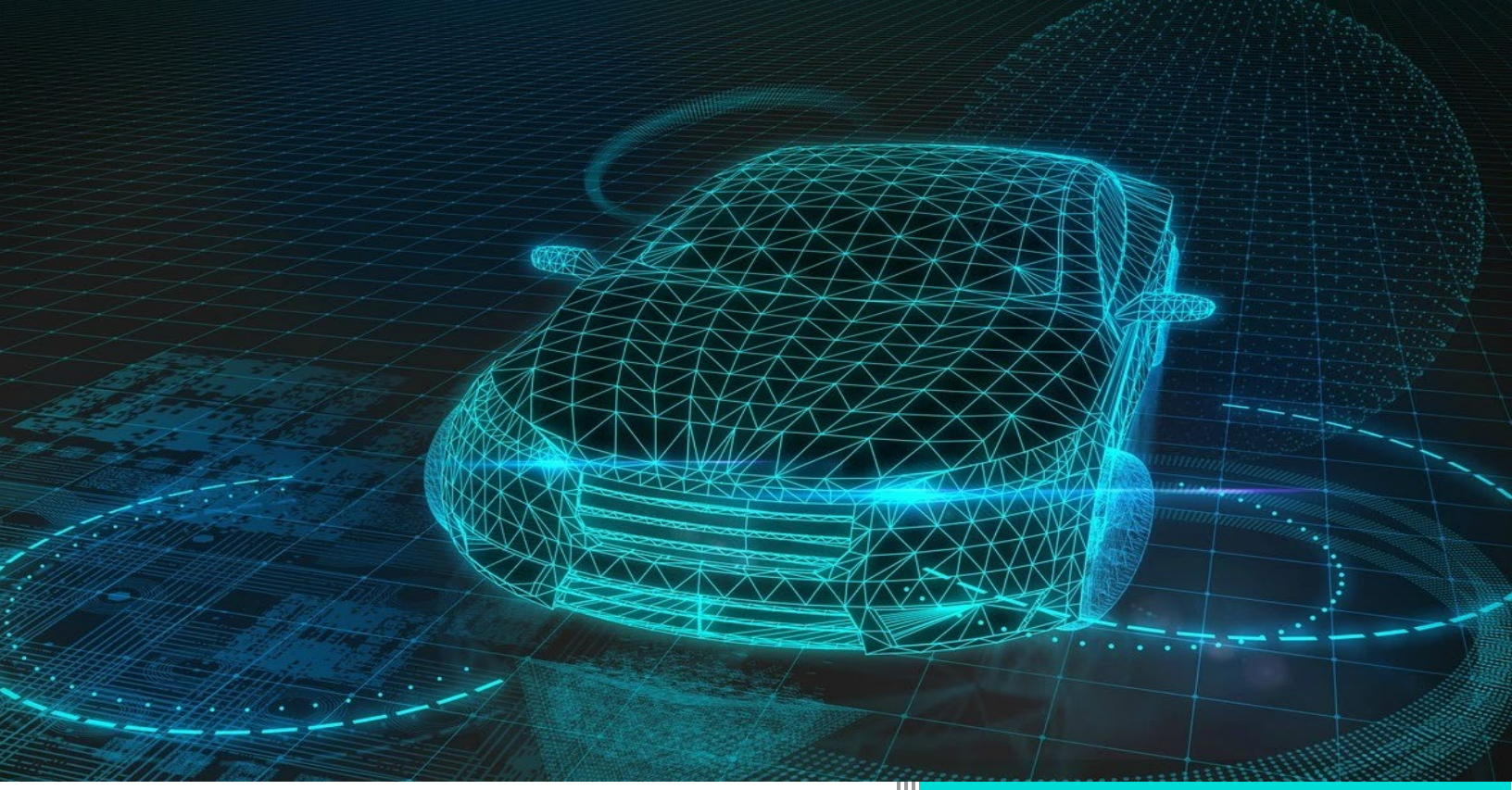


UCF RET Site: Computer Vision & Autonomous Vehicles Lesson Plan

9001320: Computer & Network Security Fundamentals: CyberSecurity I

2018

Halima Fisher, UCF RET Participant

9001320: Computer & Network Security Fundamentals: CyberSecurity I
August 3, 2018

UCF RET Site: Research Experiences in Computer Vision & Autonomous Vehicles Unit Lesson Plan

Course: Computer and Network Security Fundamentals
Grade Level: 10th – 12th grade
Suggested Length of Lesson: Approximately 6-8 Days

Materials/Technology Needed:
- Worksheets/Shared PDFS
- Projector for presentation + videos
- White Board/Smart Board
- EV3 Lego Mindstorms Bricks and Software
- Laptops/Desktop Computers
- Internet Access

Where this Fits:
- 2nd Quarter: Trends in CyberSecurity & Career pathways in CyberSecurity

Prior Knowledge:
- 1st Quarter students will have learned about: vulnerabilities and the ability to relate that knowledge to Autonomous Vehicle vulnerabilities and the concept of Confidentiality, Integrity, Availability and Authentication.

Lesson Objective(s):
- Students will demonstrate the significance of understanding basic aspects of Computer Vision as it is increasingly becoming relevant with CyberSecurity, specifically through utilizing Autonomous Vehicular CyberSecurity.
- The goal of this unit is to provide a basic foundation in computer vision & artificial intelligence so that students can see where computer vision, artificial intelligence and cybersecurity meet and can potentially create a whole new career path in cybersecurity.

Curriculum Integration Goal:
- CyberSecurity students will be able to identify the significance of learning and understanding Computer Vision for Autonomous Vehicle CyberSecurity.

Standard(s)/Benchmark(s) Addressed
- Students will be able to…
  - 18.0 Demonstrate an understanding of cybersecurity, including its origins, trends, culture, and legal implications.
  - 18.03 Describe the individual elements that comprise the CIA triad (i.e., Confidentiality, Integrity, Availability).
  - 22.0 Demonstrate knowledge of different operating systems.
  - 26.0 Demonstrate an understanding of basic security concepts.
  - 27.0 Demonstrate an understanding of legal and ethical issues in cybersecurity.
  - 29.08 Identify vulnerabilities associated with authentication.
  - 36.0 Solve problems using critical thinking skills, creativity and innovation.

Computer Vision Lessons:
- Lesson 1: Learn the History of Autonomous Cars.
- Lesson 2: Introduction to Computer Vision
- Lesson 3: Understanding different types of Car Sensors, Neural Networks & Deep Learning
- Lesson 4: Utilizing EV3 Lego Mindstorms, explore autonomous cars.

Lesson 5: Research Vehicle CyberSecurity
- Create a brochure: "How secure is your Autonomous Vehicle?
- Identifying vulnerabilities in autonomous vehicles

Instructional Strategies
- Pre & Post Assessments
- Compare and Contrast
  - Different models of autonomous vehicles
- Project-based Learning
  - Students replicate aspects of autonomous/driverless vehicles utilizing EV3 Lego Mindstorms.
  - Students seated in groups compare answers and create group responses.
- Monitoring Progress
  - Reflection/Response class questioning and written reflections

Evidence of Learning (Assessment Plan)
- Pre & Post Test Assessments demonstrating understanding of basic concepts of: Computer Vision, Artificial Intelligence & Vehicular CyberSecurity.
- EV3 Lego Mindstorms project analyzing sensors in action with the Lego Mindstorms cars.
- Research Vehicle Security & Auto-ISAC Creation of Autonomous Vehicle CyberSecurity Analysis Brochure

Description of Autonomous Vehicular CyberSecurity Lessons:					
Lessons:	**Evolution of the Motorwagen**	**Introduce Computer Vision**	**Understanding Sensors, etc....**	**EV3 Lego Mindstorms**	**Researching & Identifying Vulnerabilities**
Big Question:	Which car do you believe was the very 1st Automobile?	What is Computer Vision?	What types of sensors are used for autonomous cars?	How do sensors work?	What are the vulnerabilities in autonomous vehicles?
Learning Exploration:	Exploring the Trends in the Automotive Industry and how it has evolved from the 1st Motorwagen.	Introduce: Computer Vision: Image Acquisition Image Processing Image Analysis & Understanding	Learn about different types of sensors. Introduce: Neural Networks, Machine Learning, Deep Learning.	Complete EV3 Lego Mindstorms programming and brick training.	Continue EV3 Exploration; Research Autonomous Vehicle Vulnerabilities. Compare/Contrast different forms of autonomous vehicles sensors.
Activity	Worksheet	Worksheets & Hands-on-Activities. Pixel Art Assign.	Research Different Sensor systems in: Waymo, Tesla, Ford & Mercedes-Benz	Project-based Learning	Project-based; Research
Assessment:	Pre-& Post Assessment PPTX Questions	Pre-Post Question: What is Computer Vision	Research Assignment: Create a poster illustrating the different Sensors in major autonomous vehicles.	Simulating an autonomous parking with EV3. Advanced: Self-Driving EV3	Create a Brochure on: "How Secure is your autonomous vehicle?"

Recommended Assessment(s) and Steps

- Pre-Assessment: Prior-Knowledge Assignments posed within PowerPoint
  - Pre-Assessment Questionnaire
- Formative Assessment:
  - Introduction to Computer Vision; Object Detection; Neural Networks; Machine Learning; Deep Learning
  - EV3 Lego Mindstorms project-based learning, Group Assessment
  - Sensors Poster
- Summative Assessment:
  - Brochure created with determining, "How secure is your autonomous vehicle?", Pair Assessment
- Post Assessment:
  - Post-Test Questions, Research Assignment

List of Materials/Resources Used

- Pre & Post Assessments Questions within PowerPoint
- Assignment instructions and attachments are included/attached to PowerPoint slides
- PowerPoint –embedded videos
- EV3 Lego Mindstorms

Important Vocabulary

Term	Definition
Artificial Intelligence (AI)	The science of computers emulating humans and training machines to perform human-like tasks. (SAS)
Computer Vision	A field of Computer Science that aims at giving computers a visual understanding of the world. (Hayo)
Deep Learning	A type of machine learning that trains a computer to perform human-like tasks. Deep learning sets up basic parameters about data and trains the computer to learn on its own by recognizing patterns using many layers of processing. (SAS)
Machine Learning	A method behind how machines learn from data. It is a specific subset of AI that trains a machine how to learn. (SAS)
Neural Networks	A beautiful biologically-inspired programming paradigm which enables a computer to learn from observational data. (Nielsen)

Troubleshooting Tips

- If you don't have access to the EV3 Lego Mindstorms, you might want to consider any robotics set that has sensors and can create moving vehicles such as raspberry pi robotic sets.
- The PowerPoint has several embedded videos if they are not working feel free to refer to the reference page and re-embed them.

Advanced Learning Opportunities:

- This lesson plan serves as only an introductory lesson into Computer Vision, AI, Neural Networks, Machine Learning and Deep Learning.
- Students who are interested in diving deeper encourage them to independently pursue the following resources:
  - **University of Central Florida** will assist Crooms AoIT students interested in pursuing Computer Vision projects
    - UCF CRCV YouTube Video Lessons
  - **PowerPoint Advanced Dive Deeper Project:** EV3 Simulated Self-Driving project
  - **Machine Learning** framework for everyone by Google's TensorFlow: https://www.tensorflow.org/
  - **Neural Networks and Deep Learning** by Michael Nielsen: http://neuralnetworksanddeeplearning.com/index.html
    - Includes exercises and projects

Attachments

- PowerPoints, with Assignments included within the PowerPoints
- EV3 Lego Mindstorms Projects

References

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[SAS Institute Incorporate]. Retrieved on: 2018 August 18. SAS Insights/Analytics Insights: https://www.sas.com/en_us/insights/analytics/what-is-artificial-intelligence.html

[Hayo]. (2017 January 12). Kaiser, Adrien. "What is Computer Vision" Retrieved on: 2018 August 18. https://hayo.io/computer-vision/

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Authors:

Halima Fisher, UCF RET Participant
Kashan Athrey, UCF Graduate Student

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Professors:

Dr. Mubarak Shah, CRCV Director
Dr. Niels Lobo, CRCV Associate Professor

Rodney LaLonde, PhD Graduate Student

RET Leaders:

Dr. Josue Urbina, RET Leader
Dana Singer, RET Leader

Contact Information:

Halima Fisher – Halima_Fisher@scps.k12.fl.us