CyberSecurity4All - Teaching CyberSecurity Across The Disciplines

UNIVERSITY of HAWAI'I®
MAUI COLLEGE

Debasis Bhattacharya, JD, DBA
University of Hawaii Maui College, HI
debasisb@hawaii.edu
maui.hawaii.edu/cybersecurity
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Agenda

- Background
- Cybersecurity Education - Traditional
- Cybersecurity Education - Across Disciplines
  - Overall Approach
- Case Studies
  - Healthcare
  - Business
  - Hospitality
  - Accounting
  - Criminal Justice
- Challenges/Benefits
- Q&A

Background - College

- University of Hawaii Maui College
  - Serves Maui County - islands of Maui, Molokai and Lanai
  - 150,000 or so resident population
  - 2 Million or so tourists per year!
  - 3000+ full-time commuter students
  - 20 or so Associate Degrees
  - 3 Baccalaureate Degrees
  - 66% or so women students
  - Median age of students ~25 years
  - Non-traditional students
  - Commuter island college

Cybersecurity Education - Traditional

- Certificates in Cybersecurity
  - Low Level - Security Principles, Networking, Security Fundamentals
  - Higher Level - Ethical Hacking, Forensics
- Internships
  - Government, banks, insurance, utilities
- Baccalaureate Degree
  - Applied Business and Info Tech
  - Cybersecurity courses are embedded
- Cyber competitions, NSA GenCyber Camps
- Supported by NSF Grants
  - ATE Program Award# 1700562 (2017-20)
  - ATE Program Award# 1204904 (2012-15)
  - SFS Program Award# 1437514 (2015-17)
- Applied for NSA/DHS CAE CDE

Cybersecurity Education - Across Disciplines/Segments

- Cybersecurity educations cuts across various segments
  - Program disciplines
  - Gender
  - Minorities
  - Backgrounds - high schools, professionals, returning veterans etc
  - Various Industries
    - Accounting, Hospitality, Law Enforcement, Utility, Healthcare etc.
- One size education does not fit all types of students!

Cybersecurity Education - Across Student Population

- Focus on students from a variety of backgrounds
  - Women
  - Minorities
  - Veterans
  - Working Professionals
  - High School Students
  - Remote students who rely totally on distance education
  - Economically disadvantaged
  - Low math/science proficiency
  - Non-technical
  - Non-traditional
  - Not interested in Cybersecurity as a career!

Cybersecurity Education - Across Disciplines

- Focus on 5 disciplines at Associate Degree level
  - Healthcare
  - Business
  - Hospitality
  - Accounting
  - Criminal Justice
- Supported by NSF
  - ATE Grant - Award# 1700562
  - ATE Grant - Award# 1204904
  - SFS Capacity Building Grant - Award# 1437514

Diverse Cybersecurity Education - Overall Approach

- Obtain administration and other institutional support
- Hold workshop with faculty from various disciplines
  - Stipend helps - $250 - $300, for a one day 8 hours workshop in May
- Identify key faculty leaders in key disciplines
- Engage faculty and students during the semester
  - Guest lectures in classes
  - **Highlight relevant industry examples that involves cybersecurity**
- Identify one or two existing courses in each discipline
  - Explore cybersecurity modules that can be embedded
- Create modules and help faculty member teach it!
- Explore employers who will hire students with cyber skills
  - Hotels, banks, tourism, hospitals, law enforcement

Overall Challenges

- Faculty members need to be open and interested!
  - Cybersecurity does not appeal to all
- Faculty members need to see value
  - Inserting course modules within an existing syllabus and timeframe
- Students need need to see value!
  - See cybersecurity as a means to enhance job/career opportunities
- Embedding new courses and projects takes time and work
  - Faculty member needs time off existing work to create new modules
  - Faculty members may need to remove topics to insert CyberSec modules!
- Ongoing training to ensure new faculty can learn InfoSec
  - Making this sustainable requires one-two years of effort
- Administration needs to be behind all this effort!

Benefits!

- Hands-on projects engage diverse students with fun work!
- Cyber savvy workforce can come from various disciplines
- Increase interest in cybersecurity from a diverse group
- Grow the overall awareness of cybersecurity defense
- Enhance ability of non IT faculty to teach cyber topics

NSA CAE2Y and CAE Requirements - 5A

5. Cyber Defense is a **Multidisciplinary Practice at the Institution.**

The institution must demonstrate that Cybersecurity is not treated as a separate discipline, but integrated into additional degree programs within the institution. Courses cannot be from the department mapped to the Knowledge Units. **(7 pts mandatory/15 pts max)**

a. Cyber Defense Concepts Taught in Other Fields of Study Provide evidence that that students in other departments are exposed to cyber concepts. For example: health practitioners learning about privacy and patient data protection; or accountants learning about data backup and protection.

Provide course name and syllabus with cyber modules clearly highlighted. Cannot be courses in the department or curriculum path used to map to the Knowledge Units **(1 pt per course/3 pts mandatory/5 pts max)**

NSA CAE2Y and CAE Requirements - 5b

5. b. Non-Cyber Defense Courses Encourage Papers, Projects or Test Questions in CD topics

At least one paper/project/test questions from each of the courses submitted in 5a (cyber content clearly highlighted). Provide links or attachments to **3 to 5 best papers**, presentations, etc.- **Cyber topics clearly highlighted - within 3 years of application**. Must be at least one from each of the courses listed in 5a. Link or attachment to actual item required - not a subscription service.

(1 pt each/3 pts mandatory/5 pts max)

Case Study - Healthcare & Security Hygiene

- Malware and Security Hygiene in Small Medical Practices
- **Target Course - Intro to HealthCare Practice**
- Duration of Study - Spring 2018
- Student Researcher - **Lorraine Lopez-Osako**
    - Student in the Applied Business and IT program
    - UH Maui College BAS graduate May 2018

- Visited 15 small medical offices
- Sent out survey to all doctors
- Received 10 complete, valid responses
- Created a CyberSecurity poster for doctor's office
- **Assignment:** Case study on how small medical practices can incorporate security hygiene into daily operations?

Case Study - Business & Secure Wearables

- Security Features in Health Wearables
- **Target Course - Principles of Business**
- Duration of Study - Summer 2018
- Student Researcher - **Karina Bhattacharya**
    - Student in the Industrial Design Program
    - University of Houston, TX
- Did research on common and popular wearables
- Identified reasons for popularity and usage patterns
- Discovered reasons why security is not a main issue
- Identified issues of privacy, confidentiality and risks
- **Assignment:** Case study on how security vulnerabilities of wearables impact market share and popularity

Case Study - Hospitality & digital keys

- Digital Keys issued by Front Office Operations
- **Target Course - Hospitality Front Office Ops**
- Duration of Study - Summer 2018
- Studied use of Digital Keys using Hilton Honors app
- UHMC Hospitality Faculty Sponsor - Lorelle Peros, MBA
- Student Researcher - Mario Canul
    - Undergraduate student in CS at UH Manoa
    - Student researched the details of digital keys
    - Business benefits to hotel and customer
    - Security risks and pitfalls of digital keys
    - Future of digital keys and other technologies

- **Assignment:** Case study on how digital keys can be obtained by social engineering at the front desk

Case Study - Accounting & CryptoCurrencies

- Internal controls and cryptocurrencies
- **Target Course - Intro to Financial Accounting**
- Targeted Topic - Internal Cost Controls
- Duration of Study - Spring 2018
- UHMC Accounting Faculty Sponsor - Kelly Watanabe, MBA, MACC
    - https://www.linkedin.com/in/kelly-watanabe-65451441/
    - Teaches topic on Internal Cost Controls in ACC 201
  - Embed new learning objective and content
    - Apply internal controls to cryptocurrency receipts
    - Currently, the IRS treats virtual currencies as “property”
    - IRS Guidance - https://www.irs.gov/pub/irs-drop/n-14-21.pdf
  - **Assignment:** Case study on setting up effective cost controls to accept cryptocurrencies in a small business

Case Study - Criminal Justice & Loss Prevention

- Loss prevention of digital IP assets
- **Target Course - Principles of Loss Prevention**
- Six Principles - Prevention, Awareness, Compliance, Detection, Investigation, Resolution
- Duration of Study - Summer 2018
- Student Researcher - **Saxon Knight**
    - Undergraduate student in CS at UH Manoa
    - Studied prevention techniques in retail business
    - Loss prevention for online assets such as IP, contracts, research documents, confidential emails, pictures and other digital assets
- **Assignment:** Case study on preventing spear phishing and social engineering that targets key decision makers

C5 Cybersecurity Materials - Foundational Content

- Foundational content for cybersecurity can be found here
  - https://www.c5colleges.org/index.php/cs-course/module-downloads
- Cybersecurity Principles
  - https://www.c5colleges.org/index.php/cybersecurity-principles-module
- Cybersecurity and Society
  - https://www.c5colleges.org/index.php/cybersecurity-and-society-module
- Cyber Threats and Countermeasures
  - https://www.c5colleges.org/index.php/draft-module-cyber-threats-and-countermeasures
- The content is free and funded by NSF Grant #1548315
- Portions of the above content can be embedded as needed

Lab - Healthcare & Medical Image Processing

What's New in DIGITS 6

- Interactively train models using TensorFlow and visualize model architecture using TensorBoard
- Integrate custom plug-ins for importing special data formats such as DICOM used in medical imaging
- Pre-trained UNET model added to the DIGITS model store for image segmentation of medical images

Learn more about DIGITS 6:

- Writing a DIGITS Plug-in for DICOM files
- Getting Started with TensorFlow™ in DIGITS

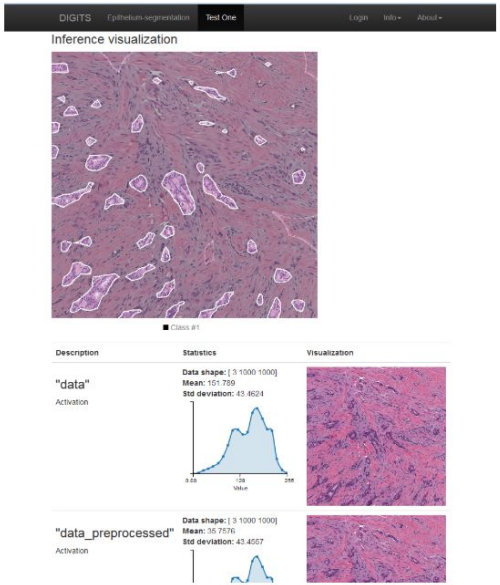
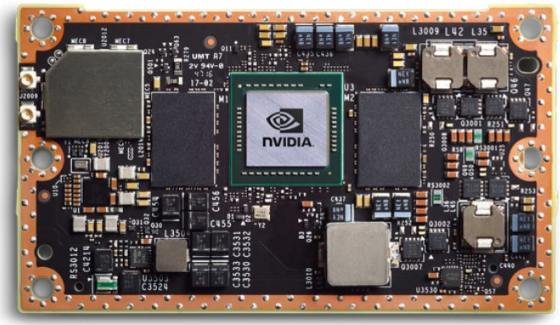


Image segmentation neural network trained with DIGITS to partition epithelium regions that contribute to identification of tumor

Lab - Electronics, Business & Embedded AI

Meet Jetson, the Platform for AI at the Edge

NVIDIA Jetson with GPU-accelerated parallel processing is the world's leading embedded AI computing platform. The Jetson portfolio of devices, featuring the new NVIDIA Jetson TX2, delivers more performance and features for Artificial Intelligence at the edge. Devices at the edge, from drones to intelligent cameras, need on-board AI to process complex data without relying on network connectivity. AI at the Edge is the future of industry, transforming processes in manufacturing, industrial inspection, agriculture, general robotics, security, and AI cities.



Jetson TX2 Developer Kit

The Jetson TX2 Developer Kit gives you a fast, easy way to develop hardware and software for the Jetson TX2 AI supercomputer on a module. It exposes the hardware capabilities and interfaces of the developer board, comes with design guides and other documentation, and is pre-flashed with a Linux development environment. It also supports NVIDIA Jetpack—a complete SDK that includes the BSP, libraries for deep learning, computer vision, GPU computing, multimedia processing, and much more.

Lab -Hospitality + Tourism & Sentiment Analysis

TensorFlow ™ Install Develop API r1.9 Versions Community Ecosystem

TFX

OVERVIEW TRANSFORM MODEL ANALYSIS SERVING

Transform
Get Started

Examples
Introduction
Sentiment Analysis

Sentiment Analysis

`sentiment_example.py` uses the Large Movie Review Dataset and contains 50,000 movie reviews equally split into train and test sets. To run this example, download and unzip the data should to a directory. Pass this directory as an argument to `sentiment_example.py`. The script creates a temporary sub-directory to add the preprocessed data.

This example is similar to the Census income example but requires more extensive Apache Beam processing before invoking `tf.Transform`. Here, the data must be read from multiple files across separate directories for positive and negative examples. Then, the correct labels are attached to the dataset and shuffled.

Lab - Business + Smart Contracts

Learn **Solidity**, a new language for smart contracts

Design and issue your own cryptocurrency

Create a tradeable digital token that can be used as a currency, a representation of an asset, a virtual share, a proof of membership or anything at all. These tokens use a standard coin API so your contract will be automatically compatible with any wallet, other contract or exchange also using this standard.

The total amount of tokens in circulation can be set to a simple fixed amount or fluctuate based on any programmed ruleset.

Lab - What are Smart Contracts anyway?

Ethereum allows developers to program their own smart contracts, or 'autonomous agents', as the ethereum white paper calls them. The language is 'Turing-complete', meaning it supports a broader set of computational instructions.

Smart contracts can:

- Function as 'multi-signature' accounts, so that funds are spent only when a required percentage of people agree
- Manage agreements between users, say, if one buys insurance from the other
- Provide utility to other contracts (similar to how a software library works)
- Store information about an application, such as domain registration information or membership records.

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Questions? Comments? Feedback?!

Debasis Bhattacharya, JD, DBA
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