Academic Program: Overview, Plans, Status

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ETI Annual Meeting, October 6, 2020
Academic Program: Overview, Plans and Status

• ETI Academic Program

• Summer program

• Academic curriculum development

• ETI 101

• Discussion

ETI Annual Meeting, October 6, 2020
Objective: multi-university program for students & professionals

The program builds and recognizes the unique nature of the ETI community diverse backgrounds

Challenges:

- Integration of nuclear engineering education and data science
- Application and relevance of chemistry, manufacturing and robotics
- Developing deep understanding of nonproliferation problems

Solution:

multidisciplinary courses offered via distance learning programs, allowing students to earn credit towards their degrees, seminars/webinars and summer schools.
Academic Program

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Program elements

Interdisciplinary curriculum
- Multidisciplinary courses hosted by ETI members
- Graduate certificate programs
- ETI 101 Introductory foundational course
- Multi-university multidisciplinary courses (manufacturing, multi-physics, detection, identification, Big Data analytics, machine learning)

Annual summer schools
- Driven by thrust areas
- Awareness of importance and breadth of topics important to NNSA mission
- Advertisement of ETI opportunities
Objective: multi-university program for students & professionals

The program builds and recognizes the unique nature of the ETI community diverse backgrounds

- **Audience**: enrolled full time and part-time students, non-degree seeking students, professional community at national labs and government
- **Credit**: through student’s home University and ETI
- **ETI recognition**: certificates
- **Delivery**: in-person, distance education/online, synchronous and asynchronous
- **Instructional Faculty**: universities, national labs, government
- **Year-round ETI Academic ecosystem**: joined collaborative efforts building a sustainable long-term educational program and resources
Summer Program

ETI is established

The goal of the summer schools: create an intense learning environment for students of various disciplines by exploiting cross-pollinating nature of the ETI Consortium

Summer School 1

Application of Machine Learning to Multidisciplinary Problems in Nuclear Nonproliferation: ROBOTICS, BIOTA & DISTRIBUTED SENSORS

2019

Summer School 2

Novel Instrumentation for Nuclear Cycle Monitoring: INTEGRAL DESIGN OF MODERN SENSORS (Theory and hands-on practice of digital electronics)

2020

Summer School 3

Advanced Manufacturing for Nonproliferation: TECHNOLOGIES AND SIGNATURES OF AM AND MAKER COMMUNITIES

2021

2022
Summer Program

our initial thoughts

• **Location:** Georgia Tech, Atlanta

• **Duration:** initial planning – 3 days

• **Timing:** summer

• **Organizers:** organizing committee or team
  university POCs and national lab experts

• **Program:** initial ideas:
  
  Day 1 - platform to engage, discuss challenges
  Day 2 - “How to” series: Data, Manufacturing, Sensors
  Day 3 - engage community/applications

• **Resources and considerations:**
  Open to all
  Hands-on experiences
  Hosted resources through ETI website
Summer Program
Summer 2020

- **Location:** Part 1 – online, Part 2 – Georgia Tech, Atlanta
- **Duration:** 1 week
- **Timing:** Part 1 - Last week of August
- **Organizers:** team of university and national lab experts
- **Program:** modules (hands-on) and lectures (applications)
- **Resources and considerations:**
  - Open to all
  - Hands-on experiences
  - Hosted resources through ETI website
The Consortium for Enabling Technologies & Innovation (ETI)

Annual Summer School
Part I (Virtual) Theme: Data Science and Engineering
August 24 – August 28, 2020

Summer school meetings begin at 11 a.m. ET

Data science methods will be introduced, including hands-on tutorials on nonproliferation applications.

Here’s what you are getting:
1. Connection between applications and data science
2. Education on the key topics
3. Introduction of resources
4. Immersive collaborative environment

Day 1 – Module 1 - Fundamentals of Data Applications
Steve Biegalski (Georgia Tech)
Lecture 1 - Nuclear-Data Analytics
Vladimir Sobes, Univ. of Tennessee, Knoxville

Day 2 – Module 2 - Computational Machine Learning
Alfred Hero (University of Michigan)
Lecture 2 - Critical Aspects of Applying Machine Learning to Nuclear Threat Detection Problems
Simon Labov, LLNL

Day 3 – Module 3 - Bayesian Modeling and Inference
John Fisher (MIT)
Lecture 3 - Data Streams and Analysis
Will Ray, ORNL

Day 4 – Module 4 - Data Science for Safeguards
Karl Pazdernik (PNNL)
Lecture 4 – Radiation Detection Data Analytics
James Ghawaly, ORNL

Day 5 – Applications, Q&A Panel

Location: https://eti.gatech.edu/eti-annual-summer-school-2020/
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2020 ETI Summer School - Registration
(214 attendees)

Academic Level (as of Fall 2020):

- PhD Student Yr 4+: 33 (15.4%)
- PhD Student Yr 3: 22 (10.3%)
- PhD Student Yr 2: 19 (8.9%)
- PhD Student Yr 1: 13 (6.1%)
- Post-masters: 10 (4.7%)
- Master’s Student Yr 3: 7 (3.3%)
- Master’s Student Yr 2: 4 (1.9%)
- Master’s Student Yr 1: 4 (1.9%)
- Post-baccs: 14 (6.5%)
- Undergrad Student Yr 3: 12 (5.6%)
- Undergrad Student Yr 2: 11 (5.1%)
- Undergrad Student Yr 1: 4 (1.9%)
- High School: 1 (0.5%)
- N/A (national lab researcher): 1 (0.5%)
- (214 attendees)
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Level of expertise in data science and engineering:

- Beginner: 36.9%
- Intermediate: 46.7%
- Advanced: 12.1%
- Expert: 4.3%

Assess your level of expertise with Python:

- Beginner: 34.6%
- Intermediate: 40.8%
- Advanced: 21.3%
- Expert: 3.3%
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Expectations:

- Take advantage of the collaborative environment to discuss ongoing ETI projects in the context of data science and engineering. 53.3%
- Gain familiarity with available resources. 64.5%
- Gain knowledge and skills in the key topics of the data science and engineering. 84.1%
- Learn about the connection between the ETI applications and data science and engineering methods. 65.4%
Academic Curriculum Development

• ETI universities, POCs
• Online delivery platforms
• Instructional team
• Modular content approach
• ETI 101 (fundamentals)
• Curriculum scope
• Pilot kick-off – Spring 2021
• Specific customization to customers (universities, etc.)
ETI 101: Fundamentals

Topics and interests from university POCs and lab experts:

- Nuclear security threats, actors, environments and attributes
- Bridge between technology and policy
- Intro to nuclear engineering
- Intro to physics and technologies in nuclear security and nonproliferation
- Materials science and engineering topics
- Chemistry, reprocessing and nuclear forensics
- Machine learning and data analysis
- Robotics and automation
- Advanced manufacturing topics
- Advanced sensors, digital instrumentation, signal processing, related electronics
- Reconstruction methods
- Data uncertainty analytics
- Etc.
Discussion

- Faculty and expert commitments
- Online delivery and access, resource hosting
- Combined delivery and recording for sustainability
- Interactive online platforms together with in-class learning opportunities at each ETI university
- Course formats – traditional/modular/mini-semesters
  - traditional – 15-16 weeks
  - days-weeks mini-semesters or modules
- Credit at home universities and through ETI certificates – per course, per module, potentially per subject area
- Content providers (development and delivery)
- Open content
- Sustainability
QUESTIONS?

THOUGHTS?

IDEAS?

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ETI Academics
(contributions, delivery, instruction, customers)

Collaboration
(contributions, delivery, instruction, customers)