

# NSA/DHS National Centers of Academic Excellence in Cyber Defense Education 2020 Annual Report

| Name of Institution   |
|-----------------------|
| University of Memphis |

| Program(s) of Study (add rows if necessary) and Department   |
|--|
| <p><b>Computer Science Department</b></p> <p><b>Programs:</b> B.S Cyber Security Concentration • Graduate Certificate in Cyber Security and Information Assurance • Ph.D in computer science with research and dissertation in cyber security</p>                                    |
| <p><b>Business Information and Technology Department</b></p> <p><b>Programs:</b> Graduate Certificate Program in Business Information Assurance • Graduate Certificate Program in Software Testing • Ph.D in BIT with research and dissertation in business information security</p> |

| Submitters Name       | Contact Information  |
|-----------------------|----------------------|
| Dr. Dipankar Dasgupta | ddasgupt@memphis.edu |

**NOTE:** Every year, NSA/DHS Centers of Academic Excellence in Cyber Defense Education and Research must submit an annual report containing information regarding student enrollment, number of graduates, student placement, research funding, and a variety of other variables. Submitting this information is a requirement for re-designation.

**Please submit your information no later than February 15, 2020. If you have questions regarding the CAE Program or the annual report itself,**



## **NSA/DHS National Centers of Academic Excellence in Cyber Defense Education**

**please feel free to contact the CAE Program Office at  
[AskCAEIAE@nsa.gov](mailto:AskCAEIAE@nsa.gov).**



# NSA/DHS National Centers of Academic Excellence in Cyber Defense Education

## I. Contact Information (since last designation)

- a. Provide name and contact information of new faculty teaching in the Program of Study
- b. Provide name and contact information for the two levels above Program of Study POC

| New Faculty  | Faculty Contact Information       |
|--|-----------------------------------|
| Dr. Christos Papadopolous                            | Christos.Papadopoulos@memphis.edu |
|  |                                   |
|  |                                   |
|  |                                   |
| Leadership Information (Department Chair, Dean, etc) | Contact Information               |
| Dr. Lan Wang-Department Chair                        | lanwang@memphis.edu               |
|  |                                   |

## II. Student Enrollment

Identify the number of students currently enrolled in the programs reflective of the CAE designation for the last academic year – identify any that apply.

| Number of students enrolled |    |  |    |
|-----------------------------|----|--|----|
| <b>AA</b>                   |    | <b>MS</b>  | 34 |
| <b>BA</b>                   |    | <b>MBA</b>   |    |
| <b>BS</b>                   | 33 | <b>PhD</b>   | 60 |
| <b>MA</b>                   |    | Other (Graduate Certificate Program in Business Information Assurance) | 20 |

## III. Graduates

Identify the number of students that have graduated from the programs reflective of the CAE designation for the last academic year – identify any that apply.

| Number of graduates |   |                             |   |
|---------------------|---|-----------------------------|---|
| <b>AA</b>           |   | <b>MS</b>                   |   |
| <b>BA</b>           |   | <b>MBA</b>                  |   |
| <b>BS</b>           |   | <b>PhD</b>                  | 4 |
| <b>MA</b>           |   | <b>Transfers</b>            |   |
| <b>GC Graduate</b>  | 1 | <b>Graduate Certificate</b> | 2 |



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|   |  |   |  |
|---|--|---|--|
| <b>Certificate<br/>(Cyber<br/>Security<br/>Information<br/>Assurance)</b> |  | <b>(Business<br/>Information<br/>Assurance)</b> |  |
|---|--|---|--|

## IV. Student Placement

- Identify where students graduating from the programs reflective of the CAE designation have placed after graduating. This metric should be categorized by the number of students placed into government, industry and academic positions for the last academic year.

| NSA | Gov | Industry | Academia | Advanced Degree | Other | Don't collect data |
|-----|-----|----------|----------|-----------------|-------|--------------------|
|     |     |          |          |                 |       | X                  |

## V. Student Development Opportunities

- “Student development opportunities” that are available to students in your program

| First column check yes if offered, second column indicate numbers of students that took advantage of the opportunity |   |  |
|--|---|--|
| X  | 2 | Internships  |
|  |   | Apprenticeships  |
| X  | 5 | Co-operative education experiences (e.g., technical directors, students & faculty work together) |
|  |   | Other (please specify)   |

## VI. Curriculum Changes

- Has your curriculum changed since your institution’s last designation application or annual report?

| Identify Courses that have been removed from the original KU mapping |
|--|
|  |
|  |
|  |



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|  |
|--|
| Identify any NEW Courses that have been added or modified in the Program of Study Path – provide a short description |
|  |
|  |
|  |
|  |
|  |

## VII. NICE Framework Crosswalk

- Identify how the mapped Program of Study path relates to the NICE Cybersecurity Workforce Framework (NCWF), NIST SP 800-181 category(s). Check all that apply:

|   | NICE Framework Categories |
|---|---------------------------|
| X | Operate and Maintain      |
|   | Oversee and Govern        |
| X | Protect and Defend        |
| X | Investigate               |
|   | Collect and Operate       |
| X | Analyze                   |
|   | Securely Provision        |

## VIII. Research Funding (applies to Bachelors, Masters, Doctoral programs)

Associate Programs skip to IX. Since the institution’s last designation application:

- Identify any significant funding for CD research relevant to the current core areas/sub area of expertise (see core area list): Principles; Security Mechanisms/Functionality; Architectures; Assurance; Operations; Analysis; Non-Technical IA Issues; or Other non-identified areas.

| Date            | Source                                   | Amt       | Brief Description   |
|-----------------|--|-----------|---|
| 10/1/14-3/31/19 | Norwich University, DHS/FEMA/DHS/FEMA II | \$331,000 | Cyber Security Competitive Training Grant   |
| 9/1/17-9/13/19  | NSA                                      | \$206,085 | CAE Cyber Security Workforce Development: This grant will be used to develop interactive, hands-on exercises to integrate in cybersecurity curriculum.<br><b>Announcement</b><br>1: <a href="http://www.memphis.edu/mediaroom/releases/2017/sept17/cybersecurity.php">http://www.memphis.edu/mediaroom/releases/2017/sept17/cybersecurity.php</a> |



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|                  |                                   |   |   |
|------------------|-----------------------------------|---|---|
|                  |                                   |   | <b>Announcement 2:</b><br><a href="http://www.memphis.edu/cs/news_and_events/news/2017_cfia_cyber_sec_curriculum.php">http://www.memphis.edu/cs/news_and_events/news/2017_cfia_cyber_sec_curriculum.php</a> |
| 1/15/16-9/30/19  | Lead: UALR<br>Prime: DHS/FEMA III | \$473, 218                              | Mobile Device Security and Privacy<br>University of Arkansas Little Rock collaboration  |
| 7/1/18-12/31/19  | FIT                               | \$15,000                                | CAST: PKChain: Decentralized Public-Key Management System Based on Blockchain Technology  |
| 9/2017-8/30/20   | FEMA/DHS                          | \$400,000                               | Preparing for Next Generation Cyber Defense   |
| 9/1/17 - 8/31/20 | Lead: NU<br>Prime: DHS/FEMA       | (Multi-University Grant of 2.2 million) | Realizing Advanced Persistent Threats<br>Norwich University Applied Research Institute  |

### IX. Institution Successes & Achievements

Since the institution's last designation application:

- Describe activities that represent successes and achievements of the program(s) reflective of the CAE designation such as scholarships, outreach, partnerships, awards, conference participation, etc.

#### Success/Achievements

The Center for Information Assurance welcomed Dr. Christos Papadopoulos and Dr. Sajjan Shiva. These faculty members are teaching cyber-related courses and conducting cybersecurity research.

#### **Dr. Christos Papadopoulos**

Dr. Papadopoulos's research interests include Computer networks, network security, multimedia communication, and distributed systems. Dr. Papadopoulos completed 2 publications in 2020 entitled:

Discovering in-network Caching Policies in NDN Networks from a Measurement Perspective  
C Fan, S Shannigrahi, C Papadopoulos, C Partridge  
Proceedings of the 7th ACM Conference on Information-Centric Networking, 106-116  
2020

Delay-based Identification of Internet Block Movement  
M Gharaibeh, C Papadopoulos, J Heidemann, C Partridge



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### Dr. Sajjan Shiva

Dr. Shiva's research interests include software systems and cybersecurity. In 2020, Dr. Shiva completed the following publications:

*Network Intrusion Detection using Natural Language Processing and Ensemble Machine Learning*

S Das, M Ashrafuzzaman, FT Sheldon, S Shiva

2020 IEEE Symposium Series on Computational Intelligence (SSCI), 829-835 2020

*Taxonomy and Survey of Interpretable Machine Learning Method*

S Das, N Agarwal, D Venugopal, FT Sheldon, S Shiva

2020 IEEE Symposium Series on Computational Intelligence (SSCI), 670-677 2020

Ads-Guard: Detecting Scammers in Online Classified Ads

S Al-Rousan, A Abuhussein, F Alsubaei, L Collen, S Shiva

2020 IEEE Symposium Series on Computational Intelligence (SSCI), 1492-1498 2020

Ensemble Classifiers for Network Intrusion Detection Using a Novel Network Attack Dataset

A Mahfouz, A Abuhussein, D Venugopal, S Shiva

Future Internet 12 (11), 180 2020

Detecting stealthy false data injection attacks in the smart grid using ensemble-based machine learning

M Ashrafuzzaman, S Das, Y Chakhchoukh, S Shiva, FT Sheldon

Computers & Security 97, 101994 4

2020

Empirical evaluation of the ensemble framework for feature selection in ddos attack

S Das, D Venugopal, S Shiva, FT Sheldon

2020 7th IEEE International Conference on Cyber Security and Cloud Computing ... 5

2020

Social-Guard: Detecting Scammers in Online Dating

S Al-Rousan, A Abuhussein, F Alsubaei, O Kahveci, H Farra, S Shiva

2020 IEEE International Conference on Electro Information Technology (EIT ... 1

2020

A holistic approach for detecting ddos attacks by using ensemble unsupervised machine learning

S Das, D Venugopal, S Shiva

Future of Information and Communication Conference, 721-738 7

2020

Network Intrusion Detection Model Using One-Class Support Vector Machine

AM Mahfouz, A Abuhussein, D Venugopal, SG Shiva

Advances in Machine Learning and Computational Intelligence, 79-86 2020

Toward an effective requirement engineering approach for cloud applications

A Abuhussein, F Alsubaei, S Shiva

Software Engineering in the Era of Cloud Computing, 29-50 2

2020

Comparative analysis of ML classifiers for network intrusion detection

AM Mahfouz, D Venugopal, SG Shiva

Fourth international congress on information and communication technology ... 11

2020

Security benchmarks for wearable medical things: stakeholders-centric approach

SR Putta, A Abuhussein, F Alsubaei, S Shiva, S Atiewi

# NSA/DHS National Centers of Academic Excellence in Cyber Defense Education

|   |      |
|---|------|
| Fourth International Congress on Information and Communication Technology ...   | 2    |
| 2020  |      |
| <b>Dr. Dipankar Dasgupta</b>  |      |
| Dr. Dasgupta has completed a myriad of activities in support of the Center for Information Assurance.   |      |
| <ul style="list-style-type: none"> <li>• Prof. Dipankar Dasgupta has been awarded U.S. Patent 10,671,747, entitled "Multi-user permission strategy to access sensitive information."<br/>The patent was filed jointly with fellow researchers Arunava Roy and Debasis Ghosh. (#10,671,747 ) by Dr. Dasgupta on multi-user permission strategy to access sensitive information approved by USPTO on June 2, 2020. For details click here.</li> <li>• Prof. Dipankar Dasgupta gave an invited talk at INNOVATE IT 2020 Conference hosted by Greater Memphis IT Council on October 8th. Event Agenda at <a href="http://www.memphisitcouncil.com/uploads/1/2/8/1/128111718/greater_memphis_it_council_innovate_it_it_program_agenda_-10-8-20_-_revised.pdf">http://www.memphisitcouncil.com/uploads/1/2/8/1/128111718/greater_memphis_it_council_innovate_it_it_program_agenda_-10-8-20_-_revised.pdf</a>. As the top Innovation in Entrepreneurship award, Dr. Dasgupta's Adaptive Multi-Factor Authentication was ranked #1 by the virtual attendees of the event.</li> <li>• Dr. Dasgupta is organizing a symposium on Computational Intelligence in Cyber Security (CICS) at the IEEE Symposium Series on Computational Intelligence (SSCI) at Canberra, Australia (Virtual) on Dec 1 - 4, 2020.</li> <li>• Dr. Dasgupta gave an invited talk at the Greater Memphis IT Council (GMITC) Cyber Security Roundtable quarterly meeting of 25 CISOs on July 21, 2020.</li> <li>• Dr. Dasgupta became a member of IEEE CIS Neural Networks Technical Committee Task Force on Secure Learning.</li> <li>• Dr. Dasgupta gave a presentation at IEEE World Congress on Computational Intelligence (WCCI) entitled "AI is not Magic—it is Computational Logic" on July 21, 2020. The presentation is available from YouTube.</li> <li>• Dr. Dasgupta received summer Grant on June 1, 2020 from Idaho National Lab to conduct research on 5G Technology Security.</li> <li>• Dr. Dasgupta received Cybersecurity Training Grant (as Co-PI) on June 1, 2020. For details: New Cybersecurity Training Grant.</li> </ul> |      |
| <b>Dr. Dasgupta contributed to the following publications for 2020:</b>   |      |
| AI-Powered Ransomware Detection Framework<br>S Poudyal, D Dasgupta<br>(SSCI), Canberra, Australia, 2020, doi: 10.1109/SSCI47803.2020.9308387 ...  | 2020 |
| Applicability issues of evasion-based adversarial attacks and mitigation techniques<br>KD Gupta, D Dasgupta, Z Akhtar<br>2020 IEEE Symposium Series on Computational Intelligence (SSCI), 1506-1515   | 1    |
| 2020  |      |
| Adversarial Input Detection Using Image Processing Techniques (IPT)<br>KD Gupta, D Dasgupta, Z Akhtar<br>2020 11th IEEE Annual Ubiquitous Computing, Electronics & Mobile ...   | 2020 |
| Machine Learning and Feature Selection Based Ransomware Detection Using Hexacodes.<br>R B.V., K G.J., R V., D D.  |      |
| Evolution in Computational Intelligence. Advances in Intelligent Systems and ...  | 2020 |



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Utility of Deep Learning Features for Facial Attributes Manipulation Detection.

Z Akhtar, M Mouree, D Dasgupta

First IEEE International Conference on Humanized Computing and Communication ...

2020

An empirical study on algorithmic bias

S Sen, D Dasgupta, KD Gupta

2020 IEEE 44th Annual Computers, Software, and Applications Conference ... 3

2020

Determining Sequence of Image Processing Technique (IPT) to Detect Adversarial Attacks

K Datta Gupta, Z Akhtar, D Dasgupta

arXiv e-prints, arXiv: 2007.00337 2020

Multi-user permission strategy to access sensitive information

D Dasgupta, A Roy, D Ghosh

US Patent 10,671,747 1

2020

Transforming healthcare cybersecurity from reactive to proactive: current status and future recommendations

SS Bhuyan, UY Kabir, JM Escareno, K Ector, S Palakodeti, D Wyant, ...

Journal of medical systems 44 (5), 1-9 9

2020

5G Enabled Energy Innovation: Advanced Wireless Networks for Science, Workshop Report

P Beckman, C Catlett, M Ahmed, M Alawad, L Bai, P Balaprakash, ...

USDOE Office of Science (SC)(United States) 2020

Adaptive multi-factor authentication system with multi-user permission strategy to access sensitive information

D Dasgupta, A Roy, D Ghosh, AK Nag

US Patent App. 16/387,839 2020

Shamir's Secret Sharing for Authentication without Reconstructing Password

KD Gupta, ML Rahman, D Dasgupta, S Poudyal

2020 10th Annual Computing and Communication Workshop and Conference (CCWC ... 5

2020

Machine learning in cybersecurity: a comprehensive survey

D Dasgupta, Z Akhtar, S Sen

The Journal of Defense Modeling and Simulation, 1548512920951275 4

2020

## **Dr. James McGinnis**

Dr. McGinnis serves as the center co director and PI of the new ROTC Training Grant awarded to the Center for Information Assurance. Dr. McGinnis was featured in the June 2020 Research and Innovation newsletter and named as a Committee member for curriculum development on the National Cybersecurity Preparedness Consortium. Dr. McGinnis additionally attended the National Cybersecurity Preparedness Consortium 508 Course Design Compliance Review Training.

## **Dr. Won**

Dr. Won's research interests consists of cyber physical systems, mobile computing, intelligent transportation systems. Dr. Won's 2020 accomplishments and publications include:

- [08/2020] Our paper is accepted to GLOBECOM'20.

# NSA/DHS National Centers of Academic Excellence in Cyber Defense Education

- [08/2020] Dr. Won was invited to serve on TPCs of WCNC and IPCCC.
- [05/2020] Dr. Won was invited to serve on TPCs of MASS and WiMob.
- [04/2020] Our paper is accepted to IEEE Access!
- [03/2020] Our paper is accepted to IEEE Access!
- [01/2020] Our paper is accepted to ICRA'20!
- [01/2020] Dr. Won was invited to serve as a guest editor for MDPI Electronics journal.

[GLOBECOM'20] B. Karki, and M. Won, "Characterizing Power Consumption of Dual-Frequency GNSS of a Smartphone".

[Access'20a] M. Won, "Intelligent Traffic Monitoring Systems for Vehicle Classification: A Survey".

[Access'20b] M. Won, A. Shrestha, K. Park, Y. Eun, "SaferCross: Enhancing Pedestrian Safety Using Embedded Sensors of Smartphone".

[ICRA'20] M. Won, "UBAT: On Jointly Optimizing UAV Trajectories and Placement of Battery Swap Stations".

## Dr. Akhtar

### Dr. Akhtar contributed to the following publications in 2020:

Contactless Multi-biometric System Using Fingerprint and Palmprint Selfies

A Herbadji, N Guermat, L Ziet, Z Akhtar, M Cheniti, D Herbadji

Traitement du Signal 37 (6), 889-897 2020

Applicability issues of evasion-based adversarial attacks and mitigation techniques

KD Gupta, D Dasgupta, Z Akhtar

2020 IEEE Symposium Series on Computational Intelligence (SSCI), 1506-1515 1

2020

Directional Neighborhood Topologies based Multi-scale Quinary Pattern for Texture Classification

E Rachdi, Y El Merabet, Z Akhtar, R Messoussi

IEEE Access 2020

Feature-level fusion of major and minor dorsal finger knuckle patterns for person authentication

A Attia, Z Akhtar, Y Chahir

Signal, Image and Video Processing, 1-9 2020

Deep rule-based classifier for finger knuckle pattern recognition system

A Attia, Z Akhtar, NE Chalabi, S Maza, Y Chahir

Evolving Systems, 1-15 2020

Accelerating deep reinforcement learning model for game strategy

Y Li, Y Fang, Z Akhtar

Neurocomputing 408, 157-168 2020

3D Palmprint recognition using Tan and Triggs normalization technique and GIST descriptors

M Chaa, Z Akhtar

Multimedia Tools and Applications, 1-15 2020

Determining Sequence of Image Processing Technique (IPT) to Detect Adversarial Attacks

K Datta Gupta, Z Akhtar, D Dasgupta

arXiv, arXiv: 2007.00337 3\*

## NSA/DHS National Centers of Academic Excellence in Cyber Defense Education

2020

Combining Multiple Biometric Traits Using Asymmetric Aggregation Operators for Improved Person Recognition

A Herbadji, Z Akhtar, K Siddique, N Guermat, L Ziet, M Cheniti, ...

Symmetry 12 (3), 444 2

2020

Weighted quasi-arithmetic mean based score level fusion for multi-biometric systems

H Abderrahmane, G Noubel, Z Lahcene, Z Akhtar, D Dasgupta

IET Biometrics 9 (3), 91-99 2020

*A Survey on Machine and Deep Learning for Detection of Diabetic Retinopathy*

A Attia, Z Akhtar, S Akhrouf, S Maza

ICTACT journal on image and video processing 11 (02), 2337-2344 2020

*Adversarial Input Detection Using Image Processing Techniques (IPT)*

KD Gupta, D Dasgupta, Z Akhtar 2020

*Utility of Deep Learning Features for Facial Attributes Manipulation Detection*

Z Akhtar, MR Mouree, D Dasgupta

IEEE International Conference on Humanized Computing and Communication with ... 2020

*Machine learning in cybersecurity: a comprehensive survey*

D Dasgupta, Z Akhtar, S Sen

The Journal of Defense Modeling and Simulation, 1548512920951275 4 2020

# NSA/DHS National Centers of Academic Excellence in Cyber Defense Education

## X. Designation Return on Investment

- Identify any opportunities, successes and/or achievements specifically resulting from the institution's designation as a CAE.

### Return on Investment

The Center for Information Assurance's (CfIA) CAE designation has opened opportunities for the center to act as a HUB for educational institutions, government agencies, and local businesses on Cybersecurity initiatives. We have had the opportunity to work with other universities that have received the CAE-CD and/or CAE-CD & CAE-R designation as a founding member of the National Cybersecurity Preparedness Consortium (NCPC) on research that has produced cutting edge research and created multiple training opportunities. The University of Memphis is proud to announce that formal agreements have been made with the following schools for shared curriculums, lectures, and teaching materials. We hope that this is the first step of many towards significantly greater exposure and recognition for the Information Technology capabilities of the participating schools and surrounding businesses. We hope that continued interest will be maintained by the Mid-South area and our efforts can encourage the growth of not only the students but also the private sector as a result of a supply of NSA certified graduates entering the job market.

#### Online Cybersecurity Courses Available

Two new online courses concerning Cybersecurity have been developed and are available for access online. These courses are funded by DHS/FEMA and are offered to the public at no charge.

The first course is titled "Understanding Social Engineering Attacks" and covers some of the techniques and tools used in social engineering. The course also offers insight to equip learners with a better understanding of how attackers use people as a "weakest" link to compromise a targeted organization. Please see the attached flyer for more information and to share with persons within your organization. This course is hosted on a FEMA funded site by the University of Texas A&M Engineering Extension Service at <https://teex.org/class/AWR367/>

The second course is titled "Mobile Device Security and Privacy". This course is designed to assist individuals to better understand security and privacy issues with mobile devices and infrastructure. Using scenarios, thought challenges and exercises as a framework, students will learn about:

- The purpose of Enterprise Mobile Management platforms
- Elements that make mobile networks and operating systems different
- Mobile malware classifications and detection strategies



# NSA/DHS National Centers of Academic Excellence in Cyber Defense Education

- Mobile architecture data leakage detection and prevention strategies.

## Silicon Valley Startup Licenses Patent for Adaptive Multi-Factor Authentication System

The University of Memphis Research Foundation has signed an agreement to license a U.S. patent for an Adaptive Multi-factor Authentication System invented and developed by a team led by Dr. Dipankar Dasgupta, professor of Computer Science and director of the Center for Information Assurance. The patent is licensed to i2Chain, a San Francisco-area cybersecurity startup, which plans to evolve adaptive authentication for its own applications as well as offer the technology as a service to other identity providers.

## Professor Dasgupta receives Innovation Award 2020

Dr. Dipankar Dasgupta, UofM Hill Professor of Cybersecurity and director of the Center for Information Assurance, was honored by the Greater Memphis IT Council at its annual INNOVATE IT conference for his development of the patent for the Adaptive Multi-Factor Authentication solution in cybersecurity.

"We conducted a live poll to select the top Innovation in Entrepreneurship and the University of Memphis Adaptive Multi-Factor Authentication was ranked #1 by the attendees. We are very proud to extend our first innovation award to Dr. Dasgupta and the University of Memphis for this outstanding application." – Regina Whitley, IT Council Executive Director.

INNOVATE IT (October 6, 2020)Event LINK: <https://www.btsvirtualevents.com/innovateit>

## Online Cybersecurity Courses Available

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- **The purpose of Enterprise Mobile Management platforms**
- **Elements that make mobile networks and operating systems different**
- **Mobile malware classifications and detection strategies**
- **Mobile architecture data leakage detection and prevention strategies.**

## Currently Engaged Schools

*Arkansas State University*

*Mid-South Community College*

*LeMoyne-Owen College*

# NSA/DHS National Centers of Academic Excellence in Cyber Defense Education

*Christian Brothers University*

*Rhodes College*

*Rust College*

In an effort to expand the influence of the program we are trying to involve as many schools as possible. Each school

in the program has the potential to collaborate with the University of Memphis in future proposals and grants.

In addition, the University of Memphis will share teaching materials with partners, offer video-lectures, investigate articulation, and promote the continuation of undergraduate and graduate students to pursue a B.S., M.S., or Ph.D. degree with available scholarships in IA. LeMoyné-Owen College, one of the nation's historically black four-year institutions, has applied for their CAE designation and has entered a mentoring relationship with us. We continue to work collaboratively with their Director of Cyber Defense to provide them guidance through this process.

## **Scholarship**

Since our designation as a CAE, we have been awarded several internal grants from the University of Memphis and external grants from government agencies for both research and education. Students have expressed a desire to participate with our institution due to the cutting edge research that we have been able to study thanks to these grants, and have ultimately allowed us to offer scholarship opportunities to both undergraduate students and graduate students. <https://www.memphis.edu/cfia/scholarships/index.php>

## **ROTC Training Program**

The CAE designation has given us the opportunity to develop a program for ROTC Research in conjunction with U of M ROTC, Arkansas State University and Arkansas State University ROTC. This will allow us to create additional opportunities to students. In 2020, the Center for Information Assurance was awarded \$318,000 to develop a cybersecurity ROTC Training Program. With this grant, we have been able to form additional partnerships with our campus ROTC departments as well as develop student publications and a cybersecurity workshop.

## **CAE Tech Talk**

The Center for Information Assurance supports The Centers of Academic Excellence (CAE) in Cybersecurity Community Tech Talk feature presentations. We encourage students to expand their knowledge by attending additional workshops and presentations. Details are given below.

**Time: 1:00 - 1:50pm EST**

**Topic: Secure Container for Data Protection in Transit and at Rest with Leakage Detection**

**Location: <https://captechu.zoom.us/j/664120328>**

**Time: 2:00 - 2:50pm EST**

**Topic: Reverse Engineering Malware (REM)**

**Location: <https://captechu.zoom.us/j/664120328>**

## **Fall 2020 Cybersecurity competition**

ServiceMaster hosted a virtual Capture The Flag for Terminix on Friday, July 31, 2020. This jeopardy-style hacking competition pits teams against each other, solving a variety of tasks in categories such as web exploitation, network forensics, and reverse engineering while finding flags and scoring points. There were three participants from The University of Memphis. The participants were Subash Poudyal, Benjamin Michael Borstad and Tony Gregory Pinson. The team scored a total of 3700 points securing the 19th position among 157 teams.

## **NSA/DHS National Centers of Academic Excellence in Cyber Defense Education**

### **Prof. Dasgupta Awarded New U.S. Patent**

Prof. Dipankar Dasgupta has been awarded U.S. Patent 10,671,747, entitled "Multi-user permission strategy to access sensitive information."

### **CAE VIRTUAL CAREER FAIR 2020**

The Centers of Academic Excellence (CAE) in Cybersecurity Community hosted the fourth annual CAE Virtual Career Fair (VCF), sponsored by the National Cybersecurity Training and Education (NCyTE) Center and the National Science Foundation (NSF), on September 4, 2020, from 9:00 am-1:00 pm. Students and cybersecurity enthusiasts were encouraged to attend to learn more about the growing field and its facilitators.

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## **XI. CAE Community Contributions**

- Check all that apply to the institution's specific contributions to the CAE Community such as attendance at CAE Community Meetings, participation in working groups, Tech Talk contributor participation in KU development and refinement, etc.

### Community Contributions

|   |   |
|---|---|
| X | Attendance at CAE Community Meetings  |
| X | Participation in CAE Working Groups   |
| X | CAE Research Collaborations   |
| X | Assistance to other institutions seeking CAE designation (e.g.; reviewers, advisors, mentors) |
|   | Tech Talk/CAE Forum speaker   |
|   | CAE Regional Resource Center (CCRC) or CAE National Resource Center (CNRC)                    |
|   | KU Development/Refinement   |
|   | Other (Please specify)  |

## **XII. Additional Information**

- Institution may use this section to provide any additional information not previously mentioned in this report pertinent to the CAE program.

### **Additional Info**





## NSA/DHS National Centers of Academic Excellence in Cyber Defense Education

Our Center's students have experienced a lot of success over the course of the past year. While working with our Center, students have completed internships, placements and other co-operative experiences to further facilitate student development opportunities. While working with the Center, these students have received both academic and moral support from our faculty and staff. Student, Ayushi Mehta, graduated in Spring 2019 (May) and started working at International Paper from September 2019 as IT Business Specialist in SAP FI team. Previously, Ayushi completed an internship at Intel Corporation in Fall 2018. Another student, Sajib Sen also completed two internships in Fall 2019. His roles included writing regression tests and implementing new functional modules that enhance codebase infrastructure for different clients and the company. Additionally, Sajib worked monitoring systems, trends and creating Knowledge Articles with in-depth explanations of various security data sources. One new course "Secure Coding and Testing" will be added to the 2020 Spring semester with the help of the Center's faculty and students. Before launching, Dr. Dasgupta tested and prepared the course materials with his graduate students and researcher, Dr. Andrew Neel. The Center for Information Assurance also welcomed new staff member Dr. James Andrew McGinnis, Jr. to the faculty. Dr. McGinnis brings the expertise of engineering technology in support of our programs and the Center for Information Assurance.



# NSA/DHS National Centers of Academic Excellence in Cyber Defense Education

## \*Core Area List

### 1. Principles

- Domains and domain separation
- Resources and resource isolation
- Privileges and least privilege
- Layering
- Application of principles to function, component and system levels
- Composition

### 2. Security Mechanisms / Functionality

- Cryptography
- Identification and Authentication
- Authorization and Access Controls
- OS/DBMS/Network mechanisms
- Trusted processes (what are they, when are they needed)
- Virtualization
- Biometrics
- Audit, monitoring, anomaly detection, DLP
- Wireless, link, and signal security

### 3. Architectures

- Network models
- OS/DBMS/Network architectures
- OS/DBMS/Network subjects and objects (active entities and data containers)
- Cloud, Grid, distributed computing
- Custom/specialized architectures (e.g., Ad-hoc networks, SCADA)
- Interconnectivity and routing
- Privilege and separation issues
- Components vs. Solutions vs. Systems
- Critical infrastructure security

### 4. Assurance

- Software
- Hardware
- Testing (functional, penetration, black box, white box, measurement, etc.)
- Modeling and Formal methods (must focus on feasibility, applicability, strengths/weaknesses)

### 5. Operations

- Configuration
- Security automation
- Intrusion detection/analysis/remediation

### 6. Analysis

- Cryptanalysis
- Malware analysis
- Forensics
- Data mining
- Process
- Audit
- Certification and accreditation

### 7. Non-technical CD Issues

- Legal issues
- Policy issues
- Privacy
- Business Case / Economics
- Awareness
- Supply Chain

