



Capability Statement

Institution: **Bethune--Cookman University, Inc.**

UEI No: **DRH4VVXLZBZ6**

Federal EIN No: **59-0704726**

Cage Code: **1RHB3**

SIC: **8221**

NAICS ID(s): **611310**

Certificates, Registrations, Accreditations: **SACSCOC, CSWE; CACREP, ACBSP, NCATE; RFEAPAC; ACEN; ACS**

POC Information:

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OVERVIEW

Bethune-Cookman University (B-CU) is a Historically Black University in Daytona Beach, located on the Florida's Atlantic coast. The B-CU campus' proximity and easy access to the coastal water bodies, the Atlantic Ocean, and the Space Coast makes it a perfect location for ocean/atmospheric, coastal, and other NASA-related education and science. Faculty and students of the MS and BS programs within the College of Science, Engineering, and Mathematics (CSEM) have been conducting research on coastal urban resilience, satellite and airborne mapping, environmental modeling & intelligence, material/nano-/particle sciences, Data Science/Machine Learning, other AI technologies, and autonomous robotics and unmanned vehicles.

RESEARCH CAPABILITIES

The B-CU CSEM faculty members have research experiences in AL, ML, NLP, including but not limited to, ML-applied to multi-robot systems, NLP models and prediction for disambiguation of language, and hybrid neural networks; and optimization of swarm systems. The faculty team members also have conducted research using environmental big data and remote sensing systems (satellite, aerial, UAS).

Capability in integrating cutting-edge information processing techniques, such as the Semantic Web/Ontology, Natural Language Processing (NLP), and Machine Learning (ML)/Deep Learning (DL) advanced methods, to advance the analysis of social media/ social science data for drug abuse epidemiology research. Our multidisciplinary framework builds on the successes of our collaborative R21 (Grant No. DA030571-01A1) and strong representation in all key areas—substance abuse epidemiology, statistical and qualitative methods, drug abuse toxicology, and state-of-the-art computational and engineering expertise. Content analysis can be extended to include temporal, geographic, and social network dimensions of social media data to track changes over time, examine regional differences, and to identify opinion leaders who influence attitudes and behaviors associated with big data use. Our team member also proposed a project that was designed to teach how to process image data (primarily satellite images), by using a dataset provided on Kaggle.com by the Defense Science & Technology Laboratory (DSTL) to detect landscape features such as roads, buildings, and natural formations. There are additional reach goals that can potentially be added to the proposed project for researchers in the "Applied Data Science" Graduate program, such as using the identified coastal and marine data, or using identified water features to locate agricultural areas far from a water/irrigation source.

Natural Sciences (Biology and Chemistry): Computational chemistry, animal behavior, marine ecosystems, molecular biology, structural and function biochemistry, synthetic biology, metabolomics, proteomics, and informatics.

Mathematics/Physics: Mathematical modeling and machine learning, nanoparticles and nanostructure engineering, data science, material science/engineering, particle physics and experimental data, nanosatellites
Computer Science/Computer Engineering/Computer Information System Data science, autonomous robotics, unmanned vehicle development, sensors, multirobot systems, embedded systems, artificial vision, robot

navigation and planning.

Integrated Environmental Science (IES): Coastal resilience and sustainability, satellite and airborne mapping and modeling, habitat restoration, aquatic biology and ecology, environmental intelligence, phytoremediation, coastal/marine ecosystems. IES has established strong local, regional, national, and international networks for coastal and marine research, outreach, and education. IES at B-CU is also a partner of National Oceanic & Atmospheric Administration-Center for Coastal and Marine Ecosystems (NOAA-CCME; <https://ccme.famu.edu/>) and Florida Institute of Oceanography (FIO; <https://www.fio.usf.edu/>).

FACILITIES

Coastal Research and Water Quality Lab: coastal laboratory and a dark room for spectral measurements. Laboratory equipment includes Turner Design fluorometers, Hach Turbidimeters, and colorimeters. Field equipment and instrumentation available to the project include Ocean Optics spectroradiometers accessories, a DSL and GoPro cameras, YSI meters, pH meters, two LiCor Photosynthetically Active Radiation meter, water samplers, and HACH and Aquaflo hand-held Fluorometers. Trimble GPS units are also available for GPS work. These resources will be used in collecting ground-truth data.

GIS and Remote Sensing Lab: 6 desktop computers, a wall-mounted monitor for remote access from the computers, and a color-laser printer. ESRI ArcGIS Pro, MS Office Suite and Adobe Creative Suite.

Data Analytics Computer Lab: The Mickens Computer Lab is equipped with 25 Lenovo ThinkCentre M93z All-in-One Desktop with 24" monitors; Sharp Interactive 70" LED-LCD Screen, Software, Built-In PC and Rolling Cart - 70LCTINT Combo; Interactive Ultra-Short-Throw Projector (Mimio 1871741). Five iMac 27-inch iMac (with Retina 5K display 3.1GHz 6-core 8th-generation Intel Core i5 processor, Turbo Boost up to 4.3GHz 16GB 2666MHz DDR4 Onboard Memory 1TB Fusion Drive storage Radeon Pro 575X with 4GB GDDR5 memory).

Robotics Lab: The BCU robotics laboratory can develop research projects in the areas of multi-robot systems and autonomous driving systems. The laboratory has three computers equipped with software for the simulation of robotic systems such as ROS and V-Rep, and 15 automated terrestrial platforms for the simulation of navigation systems based on AI and Machine learning. In addition, the laboratory has a basic robot positioning system based on the artificial vision that covers an area of twelve square meters. Additionally, the Robotics Laboratory serves as a base for the BCU IEEE Robotics Club, in which undergraduate students participate and who have participated in different competitions at the regional level.

Data Science Lab: licenses for MATLAB for statistics and machine learning, MS Office Suite, Adobe Creative Suite, and Microsoft Windows based servers and PC workstations and Software

Basic Science Research (Biology and Chemistry): Liquid chromatography (HPLC, FPLC), UV-Visible spectrophotometry (research grade and nanodrops), Temperature controlled orbital shaker platforms, Gas Chromatography, Mass spectrometry, Next-Gen Sequencing (MiSeq), BioRad microplate reader, greenhouse facility, zebrafish aquatic system.

PAST PERFORMANCE

Below please find a few examples:

The National Aeronautics and Space Administration, establish a DEAP institute and partnership in order to increase the number and research capacity as well as prepare a future workforce for data-intensive space-based earth sciences at HBCUs. The DEAP Institute's research will focus on ML-based development of a virtual constellation of satellites and other sensors to capture changing water levels from a storm event to decadal time scales in order to leverage research backgrounds of the consortium's members and partners.

The National Oceanic & Atmospheric Administration, partner with a NOAA's Cooperative Science Center, Center for Coastal and Marine Ecosystems (NOAA-CCME). The goal of the NOAA-CCME I (FY 2016-2021) and II (FY 2021-2026) is to recruit, educate, train, and graduate a new generation of scientists, particularly from underrepresented communities, in NOAA-mission aligned STEM disciplines, equipped to utilize interdisciplinary approaches to address issues confronting marine and coastal communities.

The Department of Education, (2022-2027 Title III Part B grant at B-CU) advance the institutional capacity in data-intensive environmental intelligence.

The Environmental Protection Agency and the Florida Department of Environmental Protection, construct and test the effectiveness of nature-based shorelines for controlling nonpoint source pollution and as a tool for public education.

The National Estuary Program, construct and test the effectiveness of a treatment wetland to improve stormwater management within a coastal urban watershed; restore estuarine seagrass using mosquito impoundments for potential source population and natural nursery habitat of seagrass.

The National Geospatial-Intelligence Agency, capacity building through education and research in remote sensing, especially for water resources.

DOE, General Motors, and MathWorks, The EcoCAR EV Challenge is the cutting edge of engineering education – providing an unparalleled, hands-on educational experience that transforms the traditional classroom environment into a hub of automotive innovation.

NIGMS, NIH, Support of Competitive Research Program [SCORE] SC3GM113803, Ligand Binding and Signaling State of *Anabaena* Sensory Rhodopsin Transducer