**[TOP]**

Artificial intelligence mimics aspects of human intelligence, like learning. It is generated by giving computers step-by-step instructions known as algorithms. AI can take a digital form, like a chatbot, or engineers can combine it with robotics, sensors and wireless communication to create things like self-driving cars or package-delivering drones.

FAU already has significant expertise in place. Research at the Institute for Sensing and Embedded Network Systems Engineering (I-SENSE), for example, focuses on sensing the environment and interpreting that data with AI — the sort of technology that could enable self-driving cars to detect road conditions and navigate safely. Meanwhile, researchers in the college and across the university are developing and applying AI in many ways, even exploring its ethical implications.

The university is implementing new degree options for students, including a Master of Science with a major in AI, the first such degree in the state; a multidisciplinary Master of Science in Data Science and Analytics; and a joint degree that funnels students from the Harriet L. Wilkes Honors College to a Master of Science in Data Science.

Compared to its inspiration, the human brain, state-of-the-art AI’s capabilities are limited. The technology’s greatest potential arises when used within autonomous machines that work together — like self-driving cars optimizing traffic flow, or a swarm of drones re-establishing a wireless network after a disaster.

**Communication:**

1. **Xingquan “Hill” Zhu, Ph.D.,** a professor in the College of Engineering and Computer Science, uses AI to examine large sets of interconnected data — think of social media users linked by comments and “likes.” Based on these connections, Zhu builds a map, or network, of the data and uses it to make inferences and predictions. He and colleagues, for example, built a network representing clinical trials involving infectious diseases, mapping the connections between thousands of researchers and diseases. He plans to use it to predict which trials will terminate early.

In another project, he developed AI to analyze health records to anticipate which hospital patients will be readmitted. He also works on detecting changes in data, like temperature, collected continuously by sensors.

1. **Dimitris Pados, Ph.D.,** develops new wireless technology that allows a team of machines to communicate dynamically with no human intervention, even in problematic places such as underwater. The machines sense their environments, determine the most effective means to communicate and adapt to challenges. Pados is a professor in the College of Engineering and Computer Science, an I-SENSE fellow and director of the ExtremeComms Laboratory.

**Health-care**

1. **Benhaz Ghoraani, Ph.D.,** has combined an algorithm with wearable motion sensors to monitor Parkinson’s Disease patients’ response to medication. With this information, it is possible to better adjust treatment to account for the progression of the disease. Ghoraani is an assistant professor in the College of Engineering and Computer Science, and a fellow of I-SENSE and the Brain Institute.
2. **Benhaz Ghoraani, Ph.D.,** and other researchers,developed the first algorithm that can locate patient-specific ablation targets within the atria that does not require specialized catheters or 3D electro-anatomic maps of the heart. The new algorithm – the iterative catheter navigation (ICAN) – is fundamentally different from existing approaches.
3. **Taghi Khoshgoftaar, Ph.D.**, is applying AI capable of learning to a number of medicine-related problems. His projects include testing a new tool to assess cognitive impairment associated with Alzheimer’s disease, predicting recovery time from sports-related concussions and identifying Medicare fraud. Khoshgoftaar is the Motorola Professor in the College of Engineering and Computer Science.
4. **Sameer Hinduja, Ph.D.,** combines behavioral and computer science to better identify and control cyberbullying on social media. His work helps to inform the creation of better algorithms to identify harmful content and induce users to reconsider making hurtful posts. Hinduja is a professor in the School of Criminology and Criminal Justice and co-director of the Cyberbullying Research Center.
5. \*\*\*[Stella Batalama](http://www.eng.fau.edu/directory/faculty/batalama/index.php), Ph.D., and researchers from [FAU’s](http://www.fau.edu/) [College of Engineering and Computer Science](http://www.eng.fau.edu/), [Schmidt College of Medicine](http://med.fau.edu/) and FAU’s [Harbor Branch Oceanographic Institute](http://www.fau.edu/hboi/), received a grant from the National Science Foundation to establish the first NSF-funded Major Research Instrumentation Artificial Intelligence and Deep Learning (AIDL) Training and Research Laboratory in Florida. Hosted at the university, FAU’s AIDL laboratory will significantly advance FAU’s role in artificial intelligence and deep learning-based intelligent information analysis. Batalama is the dean of FAU’s College of Engineering and Computer Science.

**Active Graduate Projects:**

1. Machine Olfaction (Emily Stark)
   1. Melanoma detection from non-invasive gas sampling (in partnership with University of Warwick)
   2. Deep-learning based classification for small datasets of high resolution data
   3. Deep-learning investigation of VOC patterns as biomarkers of respiratory infections (in partnership with IMSPEX Corporation)
   4. Autonomous broiler house monitoring for commercial growers (in partnership with Auburn University and Kansas State University)\*\*\*\*\*\*\*\*\*\*\*\*\*
2. Computational Biology (Paul Morris, Danny DaSilva, Rachael St. Clair)
   1. Convolutional neural networks for predicting molecular binding affinity to HIV-1 proteins
   2. Suppressing and modeling autoimmune disorders via primary protein sequences
   3. A deep learning approach to virtual high throughput screening (vHTS) for drug discovery
   4. Predicting neuronal orphan receptor ligand binding
   5. Automatic tracking and analysis of C. *elegans* during high throughput seizure assays
3. Human Pose Analysis (Paul Morris, Nicole Fitzgerald, Rachael Wong, Nicole Perez, Stefani Moccia )
   1. Detecting drug impairment with deep learning (collaboration with Banyan Detox Facility)
   2. AI-based feedback for prevention of body-focused repetitive behaviors
   3. Predicting therapy interaction success (in collaboration with Paul Peluso)
   4. Using gait estimation for early detection of dementia
   5. Good posture application: feedback for postural improvement
4. Gait analysis for clinical diagnosis of Alzheimer’s and related disorders (Wai Ying Tam in collaboration with James Galvin and the Comprehensive Center for Brain Health)
5. Gaze and speech-based machine-learning diagnostics of Alzheimer's disease and related disorders (Michael Kleiman in collaboration with James Galvin and the Comprehensive Center for Brain Health)

**Student Research Projects**

1. Stefani Moccia, Elan Barenholtz, and William Hahn. AI-based Feedback for Prevention of Body-focused Repetitive Behaviors 2019 Second Place Behavioral, Educational & Social Science FAU Wave Undergraduate Research Award
2. Evan Clark, Rachel St Clair, Mike Teti, Elan Barenholtz and William Hahn. Advances in deep learning and their applied utility toward chemical informatics and drug discovery. ACS Conference 2019 Accepted with Talk.
3. Paul Morris, Rachel St Clair, Mike Teti, Elan Barenholtz and William Hahn. Virtual high-throughput screening; A combined deep-learning approach. ACS Conference 2019 Accepted with Talk.
4. Morris, Paul & DaSilva, Yahchayil & Clark, Evan & Hahn, William & Barenholtz, Elan. (2018). Convolutional Neural Networks for Predicting Molecular Binding Affinity to HIV-1 Proteins. Proceedings of the 2018 ACM International Conference on Bioinformatics, Computational Biology, and Health Informatics. ACM, 2018.
5. Wilson, Kelsey & Augustin, Regynald & Morris, Paul & Clark, Evan & Hahn, William & Barenholtz, Elan. (2018). Deep Learning Guided Transcriptome Sequence Analysis of Primary Tumors for Differentiation and Diagnosis of Multiple Cancers. GPU Technology Conference, DOI:10.13140/RG.2.2.26273.71521
6. Teti, Michael, Rachel St Clair, Abrian Miller and William Edward Hahn. Deep Learning Sequence Prediction for Synthetic Biology and Genetic Engineering. iGem 2017 Accepted with Talk.
7. Geela Ramos, Fabio Ibanez, and William Hahn. Deep Learning Emotion Recognition from Photographs. 2018 1st Place Broward County Regional Science and Engineering Fair and 2nd Place Florida State County Science Fair
8. Developing a Model for Mood Disorder Classification Using Eye Movements. Michael Kleiman, Evita Conway, Elan Barenholtz and William Hahn. 2018 FAU Wave Competition. (First Place)
9. Machine Olfaction Using Deep Learning Artificial Neural Networks, Stephen Hoover, Biomedical engineering oral presentation presented the National Council on Undergraduate Research, April 2018

**Defense**

1. **Laurent Cherubin, Ph.D.**, and other researchers, are developing a novel smart-sensing system that will remotely alert authorities of incoming manned and unmanned underwater vehicles. This new bio-centric Persistent Aquatic Living Sensors (PALS) technology will augment the United States Department of Defense’s existing, hardware-based maritime monitoring systems and greatly extend the range, sensitivity and lifetime of the military’s undersea surveillance capabilities. Cherubin is an associate research professor at FAU’s [Harbor Branch Oceanographic Institute](http://www.fau.edu/hboi/).
2. **William Hahn, PhD.,** is working on a 100-pound robot dog called Astro. AI will allow Astro to learn from data so it can recognize faces, detect odors and even distress calls that would be inaudible to humans — and to make split-second decisions based on this information. Hahn is a research scientist in the Charles E. Schmidt College of Science and co-director of the Machine Perception and Cognitive Robotics Lab.

**Active Graduate Projects:**

1. Cybersecurity (Mike Teti)
   1. Detecting deep fake speech (in partnership with Los Alamos National Laboratory)

**Student Research Projects**

1. Kristen Crawford, Logan Arrandale, and William Hahn. All Ears: Can Ear Recognition Software be a Solution for Mobile Phone Security? 2019 First Place Cross-Disciplinary FAU Wave Undergraduate Research Award
2. Human Pose Analysis (Paul Morris, Nicole Fitzgerald, Rachael Wong, Nicole Perez, Stefani Moccia )

a. Classifying criminal human behavior from skeletal key points with deep neural networks

**Environment**

1. **Siddhartha Verma, Ph.D., Dimitios Pados, Ph.D., Oscar Curet, Ph.D., Georgios Sklivanitis, Ph.D., and Yufei Tang, Ph.D.**: Reinforcement learning for navigation & coordination of bioinspired underwater vehicles in close formation - “A School of Robotic Fish.” The aim is to investigate optimal control mechanisms for robots that use fin-based propulsion. The goal is to implement an autonomous controller that would allow the robotic swimmer to perform high-level tasks such as station-keeping, trajectory-following or performing collaborative tasks in groups, especially in the presence of external disturbances. The novel aspect of the ongoing work is the ability of the robotic swimmer (and eventually, of swarms) to take decisions completely autonomously in order to attain a specified high-level goal. The range of potential applications include: long-term environmental monitoring, deep water observation of aquatic animals, surveillance for coastal protection, and most-importantly, underwater search-and-rescue operations. The biggest benefit of using an autonomous controller is that individuals as well as swarms would be able to respond to unfamiliar situations and unexpected environmental disturbances. Autonomy is crucial since it may not be feasible for a human to monitor the robotic devices 24x7, or the time-delay in communication may be significant as is the case for underwater communication.

**Active Graduate Projects:**

* Autonomous ocean trash collection robot (with Department of Mechanical Engineering)
* Internet-of-Bees, with the Urban Farming Institute in Oakland Park, FL. (Matt Trask)

**Student Research Projects**

* Mary Rasura, Elan Barenholtz, and William Hahn. Recognizing the Boiling of Liquids Using Convolutional Neural Networks. 2019 Second Place Engineering FAU Wave Undergraduate Research Award
* Teti, Michael, William Hahn, and Elan Barenholtz Detecting Wading Bird Presence in Time-Lapse Images with a Convolutional Neural Network. NCUR 2017
* Development of an Air Quality Monitoring UAS for Remote Sensing Applications. Andrew Silverstein, Elan Barenholtz, and William Hahn. FAU Undergraduate Research Symposium, 2017. (First Place)
* SafetyNet: An Unsupervised Algorithm to Monitor Public Walkways. 2018 FAU Wave Competition. Prototype for machine olfaction using deep learning artificial neural networks.

**Autonomous Robots:**

1. **William Hahn, PhD.,** is working on a 100-pound robot dog called Astro. AI will allow Astro to learn from data so it can recognize faces, detect odors and even distress calls that would be inaudible to humans — and to make split-second decisions based on this information. Hahn is a research scientist in the Charles E. Schmidt College of Science and co-director of the Machine Perception and Cognitive Robotics Lab.
2. **Siddhartha Verma, Ph.D., Dimitios Pados, Ph.D., Oscar Curet, Ph.D., Georgios Sklivanitis, Ph.D., and Yufei Tang, Ph.D.**: Reinforcement learning for navigation & coordination of bioinspired underwater vehicles in close formation - “A School of Robotic Fish.” The aim is to investigate optimal control mechanisms for robots that use fin-based propulsion. The goal is to implement an autonomous controller that would allow the robotic swimmer to perform high-level tasks such as station-keeping, trajectory-following or performing collaborative tasks in groups, especially in the presence of external disturbances. The novel aspect of the ongoing work is the ability of the robotic swimmer (and eventually, of swarms) to take decisions completely autonomously in order to attain a specified high-level goal. The range of potential applications include: long-term environmental monitoring, deep water observation of aquatic animals, surveillance for coastal protection, and most-importantly, underwater search-and-rescue operations. The biggest benefit of using an autonomous controller is that individuals as well as swarms would be able to respond to unfamiliar situations and unexpected environmental disturbances. Autonomy is crucial since it may not be feasible for a human to monitor the robotic devices 24x7, or the time-delay in communication may be significant as is the case for underwater communication. (<https://www.pnas.org/content/115/23/5849/tab-figures-data>)

**Active Graduate Projects:**

1. Autonomous wheelchair, autonomous navigation and voice control (Matt Trask)
2. Evaluation of deep neural networks in an autonomous robot (Mike Teti)
3. Autonomous golf cart, add autonomous navigation and control (Matt Trask)
4. Autonomous ocean trash collection robot (with Department of Mechanical Engineering)
5. Machine Olfaction (Emily Stark)
   1. Autonomous broiler house monitoring for commercial growers (in partnership with Auburn University and Kansas State University)

6. Sparse Coding and Compressed Sensing (Mike Teti)

a. Learning attention through unsupervised sparse coding in an autonomous robot

**Student Research Projects**

1. Utilizing OpenCV for Q-Learning State Space Reduction in Re-Purposed Off-The-Shelf FPV Rovers” Paul Morris, Marcus McGuire, Shawn Martin, Nicolas Tutuianu, Washington Garcia, William Hahn and Elan Barenholtz. FAU Undergraduate Research Symposium, 2017. (First Place)
2. Rodrigo Castellon, and William Hahn. End-to-end Vehicle Control from Air Gapped Video Steam. 2018 1st Place Broward County Regional Science and Engineering Fair, 3rd Place Florida State Science and Engineering Fair, and NASA Special Recognition Award
3. Teti, Michael, Elan Barenholtz and William Hahn. A Systematic Comparison of Deep Learning Architectures in an Autonomous-Vehicle. GTC 2018. Accepted with Talk.
4. “Self-Driven” Autonomous Vehicle Exhibit at the Museum of Science and Discovery 2018.

**Social Science:**

1. **Sameer Hinduja, Ph.D.,** combines behavioral and computer science to better identify and control cyberbullying on social media. His work helps to inform the creation of better algorithms to identify harmful content and induce users to reconsider making hurtful posts. Hinduja is a professor in the School of Criminology and Criminal Justice and co-director of the Cyberbullying Research Center.

**Active Graduate Projects:**

1. Human Pose Analysis (Paul Morris, Nicole Fitzgerald, Rachael Wong, Nicole Perez, Stefani Moccia )
   1. Assessing level of interest and engagement during video viewing (Nicole Perez)
   2. Classifying criminal human behavior from skeletal key points with deep neural networks
2. Philosophy of mind and neural networks (Alex Clark)

**Student Research Projects**

1. Stark, Emily & Pitt, Jeremy & Nur Wicaksono, Alfian & Milanovic, Kristina & Lush, Victoria & Hoover, Stephen. (2018). Odorveillance and the Ethics of Robotic Olfaction [Opinion]. IEEE Technology and Society Magazine

**MPCR Student Funding**

Office of Undergraduate Research and Inquiry Grant “Noninvasive Detection of Blood Glucose Changes in Type 1 Diabetics Using eNose Breath Analysis” $1200 [Alexandra Decesare, Stephen Hoover ]

Office of Undergraduate Research and Inquiry Grant “Py Vizu Wall ” $600 [Matt Trask]

Wave Entrepreneurial Research Competition, $500 Seed Funding, Florida Atlantic University (October 2018 - Present) [Alexandra Decesare]

Distinction Through Discovery Summer Undergraduate Research Fellowship $4000, Florida Atlantic University (May-August, 2018) [Stephen Hoover]

Wave Entrepreneurial Research Competition, $500 Seed Funding & $1500 Award, Florida Atlantic University (October 2017 - April 2018) [Evita Conway]

Wave Entrepreneurial Research Competition, $500 Seed Funding & $500 Award, Florida Atlantic University (October 2017 - April 2018) [Stephen Hoover]

Wave Entrepreneurial Research Competition, $500 Seed Funding, Florida Atlantic University (October 2017 - April 2018) [Thomas Cox]

Wave Entrepreneurial Research Competition, $500 Seed Funding, Florida Atlantic University (October 2017 - April 2018) [Rachel Wong]

$16,000 FAU Seed Grant Eye-Tracking Self-Driving Car