The vision of AI2ES is to create trustworthy Artificial Intelligence (AI) methods for diverse environmental science (ES) users that will revolutionize our understanding and prediction of high-impact atmospheric and ocean science phenomena and create new educational pathways to develop a more diverse AI and environmental science workforce.

AI2ES News

Edited by Raven Reese, Dr. Amy McGovern, and Jennifer Warrillow

May 2023 Edition

Professor John J Nelson and GIS students in Corpus Christi, Texas

AI at Del Mar College

This month, the AI2ES newsletter focuses on a new AI program introduced by Del Mar College in collaboration with AI2ES. The GeoAI educational award is already a successful curriculum within the Geospatial Information System program at DMC, producing the first five graduates this spring who continue to use AI in their careers post-community college. Thank you to Dr. Phillip Davis, Professor John J. Nelson, and GeoAI graduate David Kennington for giving us an exclusive look into this highly praised pilot program

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Why AI in GIS?

Del Mar College (DMC) is a community college in Corpus Christi, TX with enrollment of about 12,000 students, offering many degrees, certificates, and awards. The ease of access to the curriculum for different types of students and over 100 degree plans allow DMC students to explore many options for their future careers. The school offers a successful Geospatial Information Systems degree, preparing students for jobs in "engineering firms, surveying companies, law enforcement, wildlife management, public utility, and local/state/federal governments". Within the past few years, the GIS program tested and generated interest in a new frontier of geospatial technology unavailable at other community colleges: AI. DMC GIS professor John J. Nelson's recent student Noah Cantu described the importance of AI as an emerging GIS tool: "Artificial Intelligence has many applications in the field of GIS; it aids land surveyors, farmers, and city planners alike with its array of capabilities." No matter their career pathway after the GIS program at DMC, students now benefit from foundational AI knowledge thanks to the college's new GeoAI program.

GIS students at DMC test out UA vehicles as a part of the hands-on program

GeoAI Program at DMC

During the development of the AI2ES proposal, our team sought an impactful approach to broaden access to AI education and provide a more streamlined and flexible pathway to obtaining an AI certificate, which could lead to further degrees or direct entry into the workforce. "In the spring of 2020, it was already clear that we were going to need a lot more AI specialists at all levels," shared AI2ES Co-PI Philippe Tissot. Given the substantial amount of data stored in Geographic Information Systems (GIS), it seemed like a great match with AI." Fruitful discussions took place involving Tissot, ESRI's Mike Beavers and Dan Stone, members of the TAMU-CBI academic advisory board, TAMUCC AVPR Colleen Fitzgerald, and Dr. Phillip Davis and his team at DMC. These discussions led to the realization that by leveraging the recently developed ESRI AI tools and the vibrant DMC GIS program, they could create a novel AI program. Within a span of six months from the initiation of the grant, the DMC team successfully developed the curriculum with the assistance of an industry advisory board and obtained program approval. Subsequently, the first class was offered in the following fall semester, and today, two and a half years after the commencement of AI2ES, the first graduates have entered the workforce.

Del Mar College now provides this specialized GeoAI program, one of the first of its type in the nation, to students of all educational backgrounds and career fields. The program attracts a range from undergraduate students just starting their academic studies to seasoned PhD graduates looking to expand their AI toolset. . Dr. Phillip Davis, Computer Science professor at DMC, operates as one of the leading instructors for this new AI2ES curriculum. The simple five-course Occupational Skills Award offered at the end of the GeoAI program prepares first- and second-year undergraduates to understand machine learning algorithms applied to geospatial technology applications. This five-course certificate largely coincides with the College's Geographic Information Systems (GIS) program and provides new AI tools to students who will pursue careers in remote sensing, land surveying, and other GIS-related fields. "Students learn the latest in machine learning algorithms in ArcGIS Pro software from Esri, Inc.," allowing undergraduates to engage with ground-breaking advances in AI while applying them to a GIS framework. In fact, of the five students who graduated from the GeoAI program last December, several moved straight into jobs related to their GIS background. This month's AI2ES Spotlight focuses on David Kennington, one of those five.

The first graduating cohort from the GeoAI Program, December 2022

AI2ES Spotlight

The best testaments to an educational program's effectiveness are those given by the students themselves. David Kennington is a recently graduated Del Mar College alumnus who joined the GeoAI program during the curriculum's first years of implementation. Kennington originally attended DMC to pursue his interest in Geographic Information Systems (GIS) and unmanned aerial (UA) technology. "(DMC's GIS) program looked very robust, and the Associate of Applied Science (AAS) degree plan was full of practical courses designed to prepare you for the workforce," he stated. As he learned more about the prospects of GIS and UA technology, Kennington discovered the emerging GeoAI curriculum developed by Geospatial Technology Professor John J. Nelson and other associates at DMC. Professor Nelson provided him an internship in developing courses and curriculum for the GeoAI program which could be substituted for some of the required classes in the AAS degree plan; this integration of the GeoAI program with an already existing AAS degree allowed uninitiated students to learn about AI in relation to the GIS program.

The GeoAI program found unprecedented success amongst its students within the first few years of implementation. With insight from student interns of the GIS program such as Kennington, the GeoAI program provides a wide array of AI knowledge that young GIS researchers want to know before entering

the field. "Being able to learn about AI from the ground up, starting with the history, ethics, and then the practical applications, gave me a great foundation of knowledge and allowed me to be able to speak on the subject with authority," Kennington explained. This exposure to AI primes students for emerging technologies in GIS research not yet available to a large number of students in similar programs across the country. Further, the GeoAI program at DMC rises above other college curriculums by removing material barriers caused by lack of access to technology. Kennington highlights how DMC's GeoAI program stands out as it "provides us with the latest hardware available in order to utilize AI, Machine Learning, and Deep Learning, in a hybrid learning environment, allowing anyone to participate in the program regardless of their home computer equipment. This was important to myself and others who didn't have the latest equipment

required to be able to handle Deep Learning." Given this access to new tools unseen by other GIS students, Kennington was more than prepared to find a career in GIS that moved with his pace towards technological progress.

As a result of his experience in the GeoAI program and his time in the Texas State Guard, Kennington graduated from DMC and immediately found a pathway into the Texas Department of Public Safety. Kennington now works as a GIS Specialist for the Texas Highway Patrol and continues "leveraging AI to identify trends and hot-spots in vehicle crash data to help make our highways and roadways a safer place." He is one of five graduating members from the DMC GeoAI program; his success after the program bodes well for students in the GIS track looking to evolve their knowledge of AI in application. Kennington recommends the curriculum to "anyone interested in GIS and AI, whether they are a new student or someone with experience looking to bolster their educational toolset." Congratulations to David Kennington on his completion of this new curriculum, and for helping to pave new pathways for students wanting to study AI in addition to GIS techniques!
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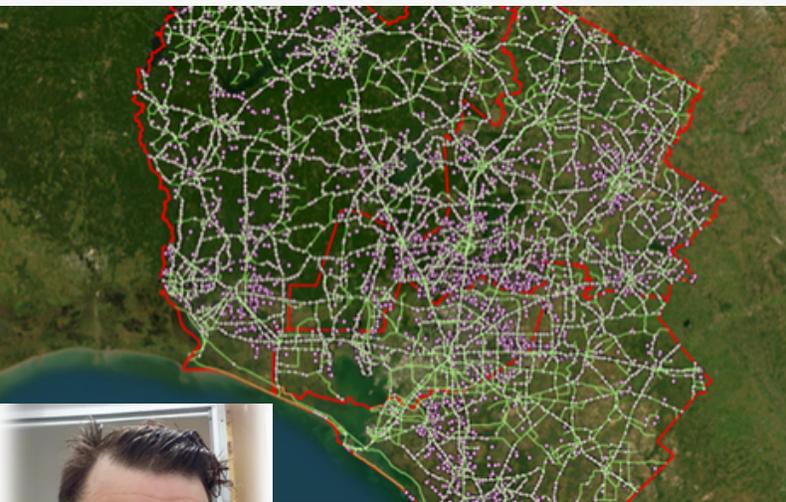
David Kennington
GIS Specialist, TX Highway Patrol
Texas Department of Public
Safety

Working Groups

We will be highlighting reports from different working groups in future newsletters. For this newsletter, we recieved updates from two groups: R2O and Robust AI. If you are interested in joining one of the groups, please contact Susan Dubbs (susan.dubbs@ou.edu).

R2O

"The R2O Working group is headed by Jebb Stewart (NOAA) and John Williams (IBM) and brings together AI2ES researchers from academia, private sector, and national labs. The jump from a published and great performing model to operations is often said to be over a "grand canyon" or a "valley of death" and is a long and tortuous process, based on the experiences of R2O group members. The AI2ES R2O group is sharing experiences and looking for ways to facilitate and accelerate the process. The team is discussing a common cloud-based platform. The team, headed by Amy McGovern, won a grant with cloud resources now available to AI2ES. The cloud resources are managed by Arnoldas Kurbanovas at the University at Albany and are already being put to good use. AI2ES also has models in operation or development such as the sea turtle and fisheries cold stunning predictions or the OU automated frontal delineation model in its next phase of R2O at IBM, p-type research at NCAR or the rapid intensification model at CIRA/CSU. The group is continuing to discuss the R2O process and what is unique about AI R2O, and continuing to evaluate options such as using Google RadLab and Google Earth tools, and work with the AWS or Azure platforms. Setting up relatively quickly a real-time AI prototype should be a key step in co-producing trustworthy AI models by engaging more comprehensively with its future users. Hopefully AI2ES researchers will soon have several other AI models to test."
-- Dr. Philippe Tissot, Chair for Coastal Artificial Intelligence, CBI at TAMU-CC

Robust AI

"The robust AI group of AI2ES is working in the direction of creating AI methods that can deal with various adversarial scenarios in learning. Such scenarios include imbalanced datasets, different kinds of noise affecting the data, adversarial labels, stability of methods to small hyper-parameter changes, and ultimately integrating such methods as part of broader supervised, unsupervised, and semi-supervised approaches for learning. Hence, while in the past we have focused on class imbalance and noisy data alone, at the moment we are working on stability of machine learning models to hyper-parameter changes, as well as on self-training methods that are using pseudo-labels and hence such semi-supervised methods should be tolerant to label noise. We are also evaluating different ML uncertainty quantification methods for how well they capture aleatoric and epistemic uncertainties and how those relate to the events being predicted."
-- Dr. Dimitris Diochnos, Professor of Computer Science, OU

Active Working Groups at AI2ES: AI2ES @ AMS 2024, R2O, Learning Journeys, and Forecast Sharpness, winter precipitation type, winter camera visibility, tropical cyclones, convective weather, S2S predictions, robust AI, ethical and responsible AI, fog prediction, sea turtle predictions, harmful algal blooms, visualizing uncertainty, risk communication and more!

New working groups are planned for the fall, so check next month's newsletter for further updates!

AI2ES In the News

NSF Newsletter

   Dr. Amy McGovern and members of CBI AI2ES at TAMU-CC appeared in last month's NSF newsletter, discussing the importance of trustworthy AI developed for the purpose of weather prediction. From sea turtles to tornadoes, AI2ES breaches new bounds and now receives larger recognition for this research!

https://new.nsf.gov/science-matters/nsf-ai-institutes-continue-creating-groundswell

CBS News

   On a global news network, AI2ES takes the spotlight again! Dr. McGovern appeared on a CBS News segment titled "How airlines can use artificial intelligence to improve flying experience." She described research conducted by AI2ES towards predicting thunderstorms that often delay or jeopardize flight paths.

https://www.cbsnews.com/video/airlines-ai-artificial-intelligence-flights/

NSF Social Media for World Turtle Day

   As a (surprise) additional shout-out on World Turtle Day 2023, NSF shared a post across their social media highlighting the sea turtle cold-stunning project researched by CBI AI2ES at TAMU-CC.

https://www.facebook.com/US.NSF/posts/pfbid02RTFcXtSXetuyZaHXMgmxX1Pr65NXSjiekGTW4jW4Cf S5k1hBU1p3WzwHYKPJjAQ7l

Future of AI for Teaching and Learning

   Join AI2ES students and faculty members on Tuesday, June 6th and Tuesday, June 13th, 2023, at noon for a discussion over the potential for AI integration in a formal classroom environment! This discussion is open to all of AI2ES, but should be of particular interest to faculty and students currently in an academic setting. Check the members@ai2es.org mailing list for an invite to the virtual meeting, titled "Brainstorming the Future of AI in Education." Dr. Amy McGovern shared a report by the Office of Educational Technology covering the topic of AI in education titled "Artificial Intelligence
and the Future of Teaching and Learning", so visit the link below for more context and meet other AI2ES members in discussion this June!

https://tech.ed.gov/files/2023/05/ai-future-of-teaching-and-learning-report.pdf

Q&A

If you were to re-enroll in a university or college program, would you stay in the same research field or change course? Why or why not?

Submit answers, resources, and questions for next month in the AI2ES Slack #general channel!