AG2PI SEED GRANT - PROJECT FINAL REPORT

PROJECT NAME	U*nderstanding emergent agricultural phenomena through Big Data Analytics: creating frameworks for understanding using Physics-guided Machine Learning and agent-based models*

PROJECT PRINCIPAL INVESTIGATOR	TODAY'S DATE	PROJECT START DATE	DATE OF COMPLETION
Michael Kantar	10-5-1	6-1-22	8-31-23
TEAM MEMBERS (co-PI, co-I, personnel)		COLLABORATORS	
Diane Wang, Bryan Runck, Barath Raghavan, Patrick Ewing, Adam Streed			

ACCOMPLISHMENTS

Please provide a short summary of the conclusions (both successes and failures) made from your project. Include a description of how this project will provide benefits to the agricultural genome to phenome community and, possibly, to a broader audience. You should include both qualitative and quantitative details, as necessary, to support your conclusions. Include a short accomplishment statement in non-technical language and do not include names.

This is not a technical report. Please keep to no more than 6-8 sentences (e.g., 1-2 sentences per point, above).

Our project had several notable accomplishments:
1) Conference in Honolulu in August 2022 – we were able to convene a meeting to write and analyze data
2) Publication of manuscript that was drafted at this meeting - Runck, B., Streed, A., Wang, D. R., Ewing, P. M., Kantar, M. B., & Raghavan, B. (2023). State spaces for agriculture: A meta-systematic design automation framework. PNAS nexus, 2(4), pgad084.
3) We are guest editors for a special issue in Crop Science that is scheduled to be published in January 2024
4) Authors of the special issue were brought together for a special session at the ASA-CSSA-SSSA annual meeting in 2023
5) We have also used the initial conference to draft further grants that we are planning to submit in 2023

(HINT: You can expand sections as necessary by pulling down on the square in the lower right corner of each box)

Products

Please list any products from this project. This may include (but not limited to) publication, concept/white paper, workshop, conference presentation, website, publicly available data or pipelines, etc. Reminder: you are required to make your prodcuts available to the broader stakeholder community using standard USDA practices, open source, FAIR, or other models. Metrics may include number of participants or times accessed, etc. Include links to recordings, DOI, etc. when possible. For presentations and posters, provide authors, date, location and presentation title.

ACTIVITY / PRODUCT	**DESCRIPTION (include URL, if applicable)**	**OUTCOME / METRICS**
PI conference in Honolulu in August 2022	This conference was used to draft an initial manuscript, plan a special issue in crop science, and plan a second meeting	This led to the plan for the entire grant
Published Manuscript in PNAS nexus	https://academic.oup.com/pnasnexus/article/2/4/pgad084/7078590	Over the past half-century, humanity has rapidly innovated to address its evolving needs. Agriculture is a notable example facing the acute and dynamic challenges of a changing climate, urbanization, evolving diets, and global biodiversity loss. We propose a framework that combines computational state space search with agriculturalist intuition such that any potential value proposition can be assessed for its potential to meet societal goals.
Special issue in crop Science initiated	https://acsess.onlinelibrary.wiley.com/journal/14350653/specialsectioncall	Cropping systems are undergoing end-to-end redesign in response to global change. With the rise of the metaverse, digital twins, and artificial intelligence approaches to addressing complex problems in food and agriculture, we are on the cusp of a world where computing can direct the design of sustainable cropping systems. However, the intellectual basis to support the computer-driven design of cropping systems lie across multiple, disconnected disciplines. As a result, work remains fragmented even though each relies on a common pool of computing techniques. This special issue will draw together scholars from agriculture, landscape ecology, food science, regional planning, geography, and computer science to show the breadth and depth of work happening in cropping system design to illustrate the commonalities across computing methods and identify open challenges in computing required for the emergence of computer-designed sustainable cropping systems.
Special session at ASA-CSSA-SSSA	https://scisoc.confex.com/scisoc/2023am/meetingapp.cgi/Session/24816	Cropping systems are undergoing end-to-end redesign in response to global change. With the rise of artificial intelligence approaches to addressing complex problems in food and agriculture, we are on the cusp of a world where computing can direct the design of sustainable agricultural systems. This special session will draw scholars from agricultural and food sciences, policy and planning, ethics, and computer science. It will highlight the breadth and depth of cross-disciplinary work in agricultural system design. It will conclude with a 60-minute breakout to identify opportunities for the emergence of computer-designed agricultural systems.

Audience

With whom has this work been targeted to and shared? Please describe how this project and its products have been disseminated to a community of interest. Include any outreach activity or information sharing as well as training or professional development opportunities provided in this project.

This work was targeted at the scientific community. We wanted to encourage discussions about ways to use computing in agricultural space. We believe that we were able to get our message to our target audience.

CONTINUATION OF WORK

Next steps

How do you/your team plan to continue moving this project forward? Include how AG2PI can assist in your forward momentum.

We plan to continue working on this topic. Each PI is submitting grants to further the work that was done on this grant, but focusing on different issues of Agricultural state space. We would like to apply to further AG2Pi funding, this was a fantastic program to work with and we felt the community was super helpful.