

AG2PI SEED GRANT - PROJECT FINAL REPORT

PROJECT NAME	Homomorphic encryption to enable sharing of confidential data
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PROJECT PRINCIPAL INVESTIGATOR	TODAY'S DATE	PROJECT START DATE	DATE OF COMPLETION
Hao Cheng	10/29/2023	9/1/2022	8/31/2023
TEAM MEMBERS (co-PI, co-I, personnel)	COLLABORATORS		
Jack C.M. Dekkers, Christopher K. Tuggle	Richard Mott, Lingzhao Fang		

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).

We've completed all the objectives in our proposal. We validated the encryption method on both simulated and real data, using distinct encryption for each company's data, and applied it to GWAS and GP using standard mixed linear models (GBLUP). We also assessed how encryption affects GWAS and GP through Bayesian variable selection methods. We presented our findings at both PAG30 and AGBT conferences.

With the progress made from the seed grant, we secured a new award from the USDA NIFA AG2PI program. Our next steps include refining methods to promote open science and collaboration in agriculture, addressing confidentiality with diverse strategies. Additionally, we're developing materials to enhance training in applying these techniques to genome-to-phenome research.

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 products 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
Presentation	Homomorphic Encryption to Enable Sharing of Confidential Data in Agricultural Genome to Phenome, AGBT, Mar 28, 2023	
Presentation	Homomorphic Encryption to Enable Sharing of Confidential Data in Genome to Phenome, PAG30, Jan 13, 2023	
AG2P Field Day	Homomorphic Encryption to Enable Sharing of Confidential Data in Agricultural Genome to Phenome	
Publication under review	Zhao, T., Wang, F., Mott, R., Dekkers., J., \textbf{Cheng, H}, Using encrypted genotypes and phenotypes for collaborative genomic analyses to maintain data confidentiality	

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.

We have presented our findings and project outcomes at several professional conferences. These conferences provided an opportunity to share our research, connect with experts in the field, and gather feedback. We organized an AG2P field day to showcase the practical applications and benefits of our project to a wider audience. This event allowed us to engage with stakeholders, including community members, practitioners, and potential end-users.

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.

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Outreach

In what ways are you able to stay engaged with AG2PI? (check boxes as appropriate)

- Will present at a field day
- Will lead a training workshop
- Would like to participate in any future AG2PI conference
- Work with AG2PI on a news release on project conclusions
- Will continue attending AG2PI events
- Other (please explain)