Billy Graham Ram

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Personal Statement

The next ten years in agricultural engineering promise groundbreaking advancements through artificial intelligence, computer vision, an array of sensors, and robotics. My research has centered on proximal hyperspectral imaging, developing deep learning models for crop traits, constructing pipelines for high-dimensional data, and integrating remote sensing and robotics. The rapid convergence of technology and agriculture is inspiring, and my five-year research journey has been dedicated to creating tools that bridge this gap, propelling us towards a more autonomous farming future.

Education

North Dakota State University, ND, USA   2020 - 2024
Ph.D. in Precision Agriculture. CGPA: 3.7/4

Sam Higginbottom University of Agriculture, Technology and Sciences, UP, India   2018 - 2020
Master of Technology in Irrigation and Drainage. CGPA: 7.6/10.00

Sam Higginbottom University of Agriculture, Technology and Sciences, UP, India   2013 - 2017
Bachelor of Technology in Agricultural Engineering. CGPA: 8.46/10.00

Work Experience

Postdoctoral Research Associate   June 2024 - present
Working in the Department of Agricultural and Biosystems Engineering at NDSU. Projects included DL model development, plant phenotyping, and robotics development. Other duties include working with Ph.D. students, data collection, industry collaborations, and other leadership roles.

Graduate Research Assistant   September 2020 - June 2024
Working as a GRA under the supervision of Dr. Xin Sun at the Department of Agricultural and Biosystems Engineering at NDSU. Works include research in Hyperspectral Imaging, embedded systems and UAV's. Additionally, maintaining and managing 84 TB of group's research database.

President Bison AgBot   January 2021 - August 2023
Played key role in starting departmental robotics club focused on creating prototypes of agricultural robots.

Teaching Assistant   August 2022 - December 2023
Working as a TA at the Department of Agricultural and Biosystems Engineering at NDSU. Teaching labs for PAG 215: Mapping of Precision Ag Data and PAG 315: Electronic Systems in Precision Ag

Teaching Assistant   August 2019 - August 2020
Worked as a Teaching Assistant in the Department of Irrigation and Drainage Engineering at SHUATS, under the supervision of Dr. ir. D.M.Denis. Work included conducting lab classes for M.Tech students, maintaining official department documents, inventory maintenance and board meeting minutes.

Founder Sowers   August 2016 - present
Founded a website (www.sowers.in) with a group of graduate students that were focused on societal issues. The aim of the website is to bring attention to issues that are termed as taboo

Technical Skills

- Programming Languages: Python (3+ years experience, proficient in Numpy, Pandas, Matplotlib, Tensorflow), MATLAB (2+ years experience)
- Software Tools: ArcGIS Pro (2+ years experience, proficient in geospatial analysis), QGIS (1+ years experience), Autodesk Fusion 360 (1 year experience), WebODM (proficient in photogrammetric reconstruction), 3D Printing (experienced with various materials and techniques), LaTeX(experience in creating high quality documents, thesis, and presentation)
- Data Analysis: Statistical analysis using tools like pandas and Scikit-learn Machine learning model development using TensorFlow Experience with data visualization and communication

Achievements

- Won the first prize in ASABE's 2024 Ethics Video Competition with a video titled, "Intrigue and Deception: When AI becomes a co-author". July 2024
- Inducted as a Barry scholar after participating in Map the Systems, Problems to Possibility competition in NDSU. Won a individual scholarship of $1000. March 2023
- Won Second prize of $550 in the American Society of Agricultural and Biological Engineer's Student Robotics Design Competition. The goal was to create a robot that could autonomously navigate and harvest cotton bolls from a simulated cotton plant. July 2022
- Won a first prize of $2000 in the American Society of Agricultural and Biological Engineer's Fresh Face Video Competition. In which I conceptualized, filmed, and edited the final video submission. January 2021
- Made a video titled,"Eye in the sky that saves money" to introduce school students to the field of Remote Sensing. This video was made with STEM @ NDSU.
- Achieved an All India Rank of 140 with 92 percentile in GATE Exam, Graduate Aptitude Test in Engineering is a national level engineering entrance examination 2019 - 2022

Publications

1. **Ram, B.**, Oduor, P., Igathinathane, C., Howatt, K., & Sun, X. (2024). A systematic review of hyperspectral imaging in precision agriculture: Analysis of its current state and future prospects. Computers and Electronics in Agriculture, 222, 109037. https://doi.org/10.1016/j.compag.2024.109037

2. **Ram, B.**, Zhang, Y., Costa, C., Ahmed, M. R., Peters, T., Jhala, A., ... & Sun, X. (2023). Palmer amaranth identification using hyperspectral imaging and machine learning technologies in soybean field. Computers and Electronics in Agriculture, 215, 108444. doi: https://doi.org/10.1016/j.compag.2023.

3. **Ram, B.**, Howatt, K., Mettler, J., Sun, X. (2024). Data Parallelism and Optimum Image Resolution: Enhancing Crop and Weed Classification in Hyperspectral Imaging with deep learning. (Under submission, April 2024)

4. **Ram, B.**, Howatt, K., Ostlie, M., Mettler, J., Sun, X. (2024). WeedCube: Proximal Hyperspectral Image Dataset of Crops and Weeds for ML Applications. (Accepted in Data in Brief, August 2024)

5. **Ram, B.**, Zhang, Y., Teresa, M.V., Sun, X. (2023). Deep Learning Model Optimization using Neural Architectural Search and Hyperparameter Tuning for Spectral Classification of Cotton Fibers. **(Under Co-author Review, October 2023)**

6. Malik, A., **Ram, B.**, Arumugam, D., Jin, Z., Sun, X., & Xu, M. (2024). Predicting gypsum tofu quality from soybean seeds using hyperspectral imaging and machine learning. Food Control, 110357. doi: https://doi.org/10.1016/j.foodcont.2024.110357

7. Ahmed, M. R., **Ram, B.**, Koparan, C., Howatt, K., Zhang, Y., & Sun, X. Multiclass Classification on Soybean and Weed Species Using a Novel Customized Greenhouse Robotic and Hyperspectral Combination System. Available at SSRN 4044574. doi: https://dx.doi.org/10.2139/ssrn.4044574

8. Rai, N., Zhang, Y., **Ram, B.**, Schumacher, L., Yellavajjala, R. K., Bajwa, S., & Sun, X. (2023). Applications of deep learning in precision weed management: A review. Computers and Electronics in Agriculture, 206, 107698. doi: https://doi.org/10.1016/j.compag.2023.107698

9. Costa, C., Zhang, Y., Howatt, K., **Ram, B.**, Stenger, J., Nowatzki, J., Sun, X. (2022). Palmer Amaranth (Amaranthus palmeri S. Watson) and Soybean (Glycine max L.) Classification in Greenhouse Using Hyperspectral Imaging and Chemometrics Methods. Journal of ASABE, 65(1), 179-188. doi: https://doi.org/10.13031/ja.14321

CONFERENCES

- Attended ASABE's AIM in Anaheim, California. Presented an abstract titled, "Herschel Vision: An Open-soure Proximal Hyperspectral Image Analysis Application." — 28th–31th July 2024
- Attended ASABE's AIM in Omaha, Nebraska. Presented an abstract titled, "Deep Learning-based Weed Identification using Hyperspectral Imaging" — 9th–12th July 2023
- Attended ASABE's AIM in Houston, Texas. Presented an Abstract and participated in a Robotics competition and won second prize. — 17th–20th July 2022
- Attended the National Workshop on Techniques in Hyperspectral Data Analysis and Processing — IESD, Banaras Hindu University, Varanasi — 27th–31st January 2020
- Attended the International Workshop on Sustainable Agricultural Mechanization: Prospects and Challenges for Indian Agriculture — SHUATS & AIT, SHUATS — 29th March 2017
- Attended the Intellectual Property Rights (IPR) workshop — SHUATS —16th November 2016
- Attended the National Conference on Science, Engineering and Information Technology for River Ecosystems Conservation, Restoration and Management organized by River Water User Association (India) on 25th-26th April 2015

PRESENTATIONS

1. Herschel Vision: An Open-soure Proximal Hyperspectral Image Analysis Application. Presented by: Billy Ram; **Ram, B.**, Xin Sun (Submission ID: 2401397, July 2024, ASABE AIM, Anaheim, CA)

2. Deep learning based weed identification using hyperspectral imaging. Presented by: Billy Ram North Dakota State University, Fargo North Dakota; **Ram B.**, Xin Sun (Submission ID: 2301457, July 2023, ASABE AIM, Omaha, Nebraska)

3. Field hyperspectral image classification of Palmar amaranth and soybean using supervised machine learning Presented by: Billy Ram North Dakota State University, Fargo North Dakota; **Ram B.**, Mohammed Raju Ahmed, Yu Zhang, Xin Sun (Submission ID: 2200721, July 2022, ASABE AIM, Houston, Texas)

4. Field application of hyperspectral imaging for weed identification Presented by: Billy Ram North Dakota State University, Fargo North Dakota; **Ram, B.**, Mohammed Raju Ahmed, Yu Zhang, Xin Sun (Submission ID: 2100787, July 2021, ASABE AIM)

OTHER INTERESTS

- Writing, Photography and documentary film-making.