Name of the faculty member	PhD topic	Brief description about the topic, and specific requirements, if any
Biplab Banerjee	Multi-agentic systems in remote sensing	
Biplab Banerjee	Continual learning of remote sensing data	
Biplab Banerjee	A domain agnostic study of object detection in remote sensing	
Avik Bhattacharya	Crop Yield Monitoring through Satellite Data Fusion	This study proposed to use satellite data fusion to monitor crop yield by combining optical, radar, and auxiliary information. The approach captures vegetation health, soil moisture, and crop stress more accurately than single-sensor methods. Fused satellite observations improve yield estimation and support better agricultural planning and decision-making.
Karthikeyan Lanka	Downscaling satellite soil moisture using multi-sensor integration	Soil moisture can now be measured using multiple satellite sensors, including SMAP SMOS Sentinel-1. Upcoming NISAR would bolster our ability to monitor soil moisture at fine resolution. However, each of these sensors have their own limitations in terms of resolution and accuracy bringing need to develop seamless high resolution soil moisture datasets by utilizing data from above sources and optical/thermal sensors. Through this project, the student will have an opportunity to develop such algorithms to improve resolution of satellite soil moisture. It is desirable for the student to have some understanding of hydrometeorological processes and Remote Sensing. Good experience with programming is also a necessary requirement.
Soumyashree Kar	Role of canopy architectural traits in crop yield prediction	Agricultural productivity faces significant challenges due to marginal land holdings and numerous unprecedented changes, such as frequent extreme weather events. To address the consumption needs, it is crucial to enhance the yields of staple crops. Several plant architectural traits have been identified to positively respond to improved field management practices. This research aims to utilize AI/ML algorithms on 3D imaging and other UAV-based phenotyping datasets to: (i) identify the leaf and canopy architectural traits that can potentially enhance yield predictions across various crop types or species, (ii) model the effects of changing environmental conditions on the identified traits and yield estimation, (iii) assess the inter- and intra-species variabilities for different crops, and (iv) develop a comprehensive framework for integrating phenotypic data with advanced modeling techniques. Candidates with Machine Learning background (especially computer vision and time series analysis) and with an interest in vegetation studies will be preferred.

Soumyashree Kar	Quantifying stress severity levels in field crops using multi-modal learning	Plant phenotyping experiments conducted indoors under controlled conditions often fail to translate effectively to field environments, where changing ambient conditions continually influence plant growth. Furthermore, multiple plant stresses can occur simultaneously, with some stressors being secondary effects that are not visually observable (using RGB cameras). Therefore, to enhance our understanding of plant stress dynamics and crop resilience, this research aims to utilize hyperspectral imaging, along with other aerial and proximal remote sensing data, to: (i) identify pre-visual stress indicators, (ii) model and compare the effects of extraneous factors on healthy and stressed plants in both lab and field conditions, (iii) quantitatively differentiate the development of various stresses (biotic or abiotic or both in some cases with similar symptoms) across different crop types, and (iv) develop an integrated multi-modal learning pipeline to automate stress detection and quantification. Candidates with Machine Learning background (especially computer vision and time series analysis) and with an interest in vegetation studies will be preferred.
Pritam Das	Multi-Satellite Surface Water Probe	Satellites provide a unique opportunity to take Earth observations at a large scale. There also exists a wide range of sensor types that measure different aspects of closely related observables, such as water surface area and water elevation by optical and altimeter satellites. Individually, satellites such as JASON-3, Landsat series, Sentinel series, and SARAL-AltiKa have a proven record of providing vital observations about the hydrologic cycle. Furthermore, combining different modalities of observations (MW radar and optical IR) has also proven to be very effective in filling the gaps and weaknesses of individual sensors. The scholar in this project will be working towards combining multi-source satellite data for measuring variables specific to surface freshwater, in light of the recently available data from the Surface Water and Ocean Topography (SWOT) satellite mission. The focus would be especially on the elevation, surface area, and volume of water. The project will involve developing public-facing dashboards in later stages of the project.Required: - Demonstrable background in geoinformatics/hydrology/earth sciences/geomatics or allied areas. Desired: - Satellite remote sensing - Machine Learning - Programming/computing know-how - Statistics/data science skills - GIS - Scientific writing A strong enthusiasm to pick up the necessary skills can also substitute for the desired skills.

Pritam Das	Quantifying Streamflow in Regulated Rivers	Rivers in the 21st century require explicit consideration of regulatory structures such as dams. Streamflow of most rivers is regulated by the operation of dams that may vary in their primary usage, with each type having its unique signature of regulation. In existing approaches, reservoirs are usually parameterized as a function of downstream demand or storage in the reservoir. Such methods may not holistically represent the reservoir operations, which often have to adapt rapidly to changing conditions and are often at the discretion of the dam operator, making it difficult to model. The Reservoir Operations-driven River Regulation (ResORR) model uses estimates of reservoir operations to adjust downstream streamflow to holistically represent reservoir operations in the system. The scholar in this project will develop the ResORR model further. The goal would be to improve the accuracy of regulated streamflow and to quantify the uncertainty, potentially using an ensemble approach. The project will involve developing public-facing dashboards in later stages of the project. Required: - Demonstrable background in hydrology/remote-sensing/earth sciences/geoinformatics/geomatics/mathematics/statistics/allied areas. Desired: - Hydrological Modeling - Programming/computing know-how - Statistics/data science skills - GIS - Scientific writing A strong enthusiasm to pick up the necessary skills can also substitute for the desired skills.