Centre of Studies in Resources Engineering
Ph.D. Topics for Autumn 2022 Semester (Jul. - Dec. 2022)
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Faculty Name	Topic	Details	Prerequisites
Prof. Avik Bhattacharya	**Modelling of forest disturbances using multi sensor remote sensing**	Synergies between multispectral and radar based-detections will be explored to map forest disturbances. The study will develop models for the rapid identification of forest disturbances using multi-sensor time-series satellite data. Different anthropogenic and natural impacts cause disturbances in forests. These disturbances can be of any kind, such as fires, disease, storms, deforestation, etc. Moreover, the work will provide an early warning system for forest fires, which can help sustain the forest ecosystem's sustainable management.	Good knowledge of multi-sensor data handling and analysis. Scientific programming skills in Python Python/MATLAB/R. Working experience in GIS platform.
Prof. Avik Bhattacharya	**Crop classification and bio-physical parameter estimation using SAR data**	The study will exploit different SAR data for crop classification and biophysical parameter estimation.	Good knowledge of SAR data analysis. Scientific programming skills in Python Python/MATLAB/R. Experience in agriculture remote sensing is desirable.
Prof. Gulab Singh	**Ice sheet modeling**		
Prof. Gulab Singh	**Modeling and forecasting of climate warming-induced glacier deformation**		
Prof. Gulab Singh	**EM scattering modeling of vegetated and non-vegetated snowpack region and snow mass estimation**		

Prof. Alok Porwal	**Global cratonic boundaries: Implications for mineral exploration**	Global satellite-based remote sensing, gravity images and DEM data would be used for demarcarting cratons and translithospheric structures world-wide. A global mineral deposit database will be generated; and geosptial analysis tools would be used to develop insights into the fertility of cratons and identify mineral prognostic areas	Good knoweldge of Geology, Tectonics and Geophysics. Knoweldge of remote sensing and GIS would be added preferable.
Prof. Alok Porwal	**Geological feature learning and unsupervised mineral prospectivity modeling**	Apply unsupervised machine learning techniques (e.g., SOM) for extracting mineral-deposit-related features from geoscience datasets, validate them against geological knoweldge, and apply to exploration targeting	Preferably a computer science or geology graduate with interest in ML/data mining.
Prof. Alok Porwal	**Sulfate deposits on Mars: Age, origin and implications for paleoclimate of Mars**	Use orbital V-NIR-SWIR and TIR data for mapping sulfate deposits on Mars, work their ages using drater counting, develop theories for their origin and understand the implications for Martian palaeoclimate	Preferably a physical chemistry, physics or geology graduate with interest in planetary geology.
Prof. Surya Durbha	**Embedded High Performance Multi-Sensor (LiDAR, Multi-Spectral, SAR) Data fusion and Analytics**	Development of Algorithms, Hardware and Software for rapid detection and monitoring of affected areas during extreme events.	
Prof. Surya Durbha	**Geospatial Knowledge Representation based Framework for Disasters**	Develop knowledge graphs/ Ontologies based knowledge representation and reasoning framework for Indian Flood disasters	
Prof. Karthikeyan Lanka	**Monitoring Soil Moisture and Vegetation using Passive Microwave Satellite Radiometry**	Goal of the project is to develop high quality soil moisture and vegetation information using passive microwave sensors SMAP and SMOS. In this process, synergies between microwave and optical/thermal sensors shall be explored.	Candidate is required to have good programming knowledge in any of the platforms such as MATLAB/R/Python etc. Some background on remote sensing (ideally microwave remote sensing) and AI/ML is desirable.

Prof. Karthikeyan Lanka	**Soil moisture-precipitation feedbacks in the context of extreme events using satellite data and regional climate models**	Soil moisture feedback to precipitation is an important driver that determines the land contributions to the total precipitation. Assessment of land feedbacks is very important in the context of agriculture and extreme events. However, it is challenging to partition these fluxes into atmospheric and land contributions. The overarching goal of this research is to develop algorithms that synergistically use satellite products and numerical weather prediction models to address science questions pertaining to drought monitoring and prediction and impacts of agriculture on climate.	Candidate is required to have basic understanding about land and atmosphere processes. Candidate is required to have good programming knowledge in any of the platforms such as MATLAB/R/Python etc. Experience with WRF modeling is desirable.
Prof. Karthikeyan Lanka	**Developing high resolution soil moisture to improve monitoring of agricultural droughts**	Develop novel algorithms to estimate soil moisture at high resolution possibly at sub kilometre scales. Subsequently, the utility of developed datasets shall be analyzed for drought monitoring and other agricultural applications.	Candidate is required to have good programming knowledge in any of the platforms such as MATLAB/R/Python etc. Some background on microwave remote sensing and AI/ML is desirable.