Project Title: Crop Yield Forecasting using Earth Observation (EO) Satellite datasets

Project Number: IMURA0898

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Research Clusters:
Highlight which of the Academy’s CLUSTERS this project will address?
(Please nominate JUST one. For more information, see www.iitbmonash.org)

1. Material Science/Engineering (including Nano, Metallurgy)
2. Energy, Green Chem, Chemistry, Catalysis, Reaction Eng
3. Math, CFD, Modelling, Manufacturing
4. CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control
5. Earth Sciences and Civil Engineering (Geo, Water, Climate)
7. Semi-Conductors, Optics, Photonics, Networks, Telecommm, Power Eng
8. HSS, Design, Management

Research Themes:
Highlight which of the Academy’s Theme(s) this project will address?
(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research
7. Humanities and social sciences
8. Design
### The research problem

Crop yield forecasts a few months before harvest can be of paramount importance for a range of agricultural and food security decisions. Forecasting enables planners and decision makers to determine how much to import (in shortfall case) or optionally, to export (in surplus case). Traditionally, crop yield estimation depended upon the data collected from ground-based field visits. Such a technique is often subjective, costly and is prone to large errors, leading to poor crop assessment and crop area estimation. With the successful launch of various satellites having different spatial, temporal and spectral imaging capabilities, efforts are being made worldwide to use remote sensing data for yield forecasting. However, still many challenges exist due to crop model parameterization, remote sensing data (scale effect, retrieval strategy and method) and linking remote sensing data with the crop model. Therefore, how to combine the advantage of different remote sensing data with crop models for improving the estimation accuracy of canopy state variables and soil properties using intelligent algorithms becomes an important question, which needs immediate attention.

### Project aims

Considering that satellite remote sensing has the potential to provide timely, systematically high quality spatial and accurate information on crop growth, the project aims to develop a crop yield forecasting framework for major food grain such as wheat crop, through sequential assimilation of various remotely sensed data (ET, soil moisture) into crop growth models. The project also aims to test and validate such a forecasting system in diverse regions like India and Australia.

### Expected outcomes

Remote sensing-based crop yield forecasting framework suitable for operational purposes. There is a likelihood of obtaining patent for the proposed framework.

Two-three high impact publications.

### How will the project address the Goals of the above Themes?

The project fits into the themes of “Advanced computing & simulations and Water”. For example, the project involves big data analysis involving space borne Earth Observation (EO) datasets, simulation of complex crop growth models and data assimilation of the EO data. In addition, crop yield forecasting will also lead to an understanding about crop water requirement and irrigation which are crucial in water management.

### Capabilities and Degrees Required

The candidate should have an exceptional academic background and a strong interest in research. Candidates with B.Tech/MSc./M.Tech degrees related to the fields of water resources/ Remote Sensing/Agriculture are encouraged to apply. Experience in computer programming (Matlab, Python etc.) and mathematical knowledge including numerical techniques and probability and statistics are required. Any prior experience of using numerical models will be considered as an advantage. The student should have good attitude towards mathematical concepts and modelling. In addition the candidate should have excellent oral and written communication skills in English and should be able to undertake field visits for crop data collection.

### Potential Collaborators

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<tr>
<th>At IITB</th>
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<tr>
<td>Prof. Pennan Chinnasamy, CTARA; Prof. Adinarayana, CSRE</td>
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Select up to (4) keywords from the Academy’s approved keyword list (available at http://www.iitbmonash.org/becoming-a-research-supervisor/) relating to this project to make it easier for the students to apply.

Data Science Optimisation, Algorithm; Modelling and Simulations; Water