

An Indian-Australian research partnership



**Project Title:**

**Application of model data fusion techniques for natural hazards modelling and analytics in developing countries especially in the Indian Sub-continent.**

**Project Number**

**IMURA0726**

**Monash Main Supervisor**

(Name, Email Id, Phone)

Christoph Rudiger [chris.rudiger@monash.edu](mailto:chris.rudiger@monash.edu)

Full name, Email

**Monash Co-supervisor(s)**

(Name, Email Id, Phone)

Ha Bui, [ha.bui@monash.edu](mailto:ha.bui@monash.edu)

**Monash Head of**

**Dept/Centre** (Name,Email)

Jeffrey Walker [jeff.walker@monash.edu](mailto:jeff.walker@monash.edu)

Full name, email

**Monash Department:**

Civil Engineering

**Monash ADRT**

(Name,Email)

Emanuele Viterbo [emanuele.viterbo@monash.edu](mailto:emanuele.viterbo@monash.edu)

Full name, email

**IITB Main Supervisor**

(Name, Email Id, Phone)

RAAJ.Ramsankaran [ramsankaran@civil.iitb.ac.in](mailto:ramsankaran@civil.iitb.ac.in)

Full name, Email

**IITB Co-supervisor(s)**

(Name, Email Id, Phone)

Full name, Email

**IITB Head of Dept**

(Name, Email, Phone)

KVK Rao [kvkrao@iitb.ac.in](mailto:kvkrao@iitb.ac.in)

Full name, email

**IITB Department:**

Civil Engineering

**Data61 Supervisors**

Mahesh Prakash and Vincent Lemiale

**Research Clusters:**

**Research Themes:**

Highlight which of the Academy's CLUSTERS this project will address? <i>(Please nominate JUST <u>one</u>. For more information, see <a href="http://www.iitbmonash.org">www.iitbmonash.org</a>)</i>		Highlight which of the Academy's Theme(s) this project will address? <i>(Feel free to nominate more than one. For more information, see <a href="http://www.iitbmonash.org">www.iitbmonash.org</a>)</i>	
1	Material Science/Engineering (including Nano, Metallurgy)	1	<b>Advanced computational engineering, simulation and manufacture</b>
2	Energy, Green Chem, Chemistry, Catalysis, Reaction Eng	2	<b>Infrastructure Engineering</b>
3	Math, CFD, Modelling, Manufacturing	3	Clean Energy
4	CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control	4	Water
5	<b>Earth Sciences and Civil Engineering (Geo, Water, Climate)</b>	5	Nanotechnology
6	Bio, Stem Cells, Bio Chem, Pharma, Food	6	Biotechnology and Stem Cell Research
7	Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng		
8	HSS, Design, Management		

**The research problem**

### *Define the problem*

The key issue in getting a better understanding of natural hazard risks such as floods and landslides in developing countries is the lack of availability of good quality datasets. With the advent of high-resolution optical satellites such as Cartosat 2 by ISRO (resolution > 0.65 m) in India and the offering by DigitalGlobe and PlanetLabs, in addition to other types of satellites, there is the unprecedented ability to gain access to such remotely sensed data sources and potentially utilize these as inputs into natural hazards modelling and predictive capabilities. CSIRO Data61 has expertise in both performing image analysis and 3D reconstruction of terrain from satellite data sources as well as know-how related to the input of such datasets into complex flood and landslide model and analytics tools. This project will have wide reaching implications for the ability to predict natural hazard events in developing countries.

## **Project aims**

### *Define the aims of the project*

The aim of this project is to evaluate the applicability of high-resolution satellite data that are becoming ubiquitous for natural disaster related applications especially in the context of developing and under-developed countries. This is to significantly reduce the cost of data acquisition from airborne LiDAR like sources.

## **Expected outcomes**

### *Highlight the expected outcomes of the project*

1. Development of image analysis and machine learning based algorithms to extract key datasets such as roads, buildings and other key infrastructure from high resolution satellite based sources.
2. Development of a ranked infrastructure asset database following on from the image analysis exercise based on asset risk classification (for example can we access information around critical infrastructure such as schools, hospitals etc. using the resolution allowed by satellite data). This step will necessarily need at least one case study location of interest in India which has issues with flood/landslide risk.
3. Application of a flood/landslide model to the identified case study location to demonstrate the usability of the derived datasets for natural hazard vulnerability analysis. It would be preferable to choose an area which has some historical data available associated with a natural hazard event for example Mumbai metropolitan region.
4. All the algorithms developed as part of this project will be done within the workspace workflow framework developed by CSIRO Data61 (<https://research.csiro.au/Workspace>) such that these could be shared with the project team based in Australia and India.
5. Publications in two to three high quality and high impact journals in related areas.

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

*Describe how the project will address the goals of one or more of the 6 Themes listed above.*

### **Advanced computational engineering, simulation and manufacture**

*One of the key aims of the project is to develop advanced image analysis and machine learning based algorithms to extract information around key infrastructure from satellite datasets.*

### **Infrastructure Engineering**

*The ability to classify vulnerable infrastructure from a natural disaster perspective is a key outcome of this project.*

### **Water**

*A key application of the outcome of this project is the ability to identify infrastructure that is at risk of flooding especially in urban locations in developing countries.*

## Capabilities and Degrees Required

*List the ideal set of capabilities that a student should have for this project. Feel free to be as specific or as general as you like. These capabilities will be input into the online application form and students who opt for this project will be required to show that they can demonstrate these capabilities.*

The student will need to have demonstrable strengths in statistical and mathematical modelling as well as in Geographical Information Systems (GIS). The student will also need to have excellent programming skills in C and/or C++. An appreciation of fluid mechanics especially in the hydrodynamic and hydrological context will also be very highly regarded. The student could have a degree in a related area of engineering, mathematics or in physics.

## Potential Collaborators

*Please visit the IITB website [www.iitb.ac.in](http://www.iitb.ac.in) OR Monash Website [www.monash.edu](http://www.monash.edu) to highlight some potential collaborators that would be best suited for the area of research you are intending to float.*

Select up to **(4)** keywords from the Academy's approved keyword list (**available at [www.iitbmonash.org](http://www.iitbmonash.org)**) relating to this project to make it easier for the students to apply.