



**Project Title:** Machine Learning in Additive Manufacturing

**Project Number** IMURA1031

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**IITB Department:** Mechanical Engineering

**Research Clusters:**

**Research Themes:**

<b>Highlight which of the Academy's CLUSTERS this project will address?</b> <i>(Please nominate JUST <b>one</b>. For more information, see <a href="http://www.iitbmonash.org">www.iitbmonash.org</a>)</i>	<b>Highlight which of the Academy's Theme(s) this project will address?</b> <i>(Feel free to nominate more than one. For more information, see <a href="http://www.iitbmonash.org">www.iitbmonash.org</a>)</i>																														
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### **The research problem**

Different from traditional subtractive manufacturing through removing unneeded materials, additive Manufacturing (AM), also known as 3D-printing, builds components by adding materials layer upon layer. In this way, additive manufacturing can produce near-final-shape components automatically from computer design files without the need for tooling, leading to material savings of up to 90% production cost savings of up to 50% and reductions in lead-time from design to final component of up to 90%. Due to these advantages, additive manufacturing, a key part of the Fourth Industrial Revolution (or Industry 4.0), is evolving rapidly from research, application to software development.

Machine learning is an artificial intelligence (AI) technique that allows a machine or system to learn from data automatically and make decisions or predictions without being explicitly programmed [1]. Very recently, machine learning is considered as an agile mathematical method to solve many problems in additive manufacturing, such as design for additive manufacturing and optimising additive manufacturing process, etc.

### **Project aims**

This PhD project aims to further apply and develop machine learning method in advancing additive manufacturing. Comprehensive literature reading will be carried out to gain the state-of-art applications of machine learning in additive manufacturing and understand the challenging issues related to additive manufacturing. From there, specific research questions will be formulated and solutions will be explored.

### **How skills/experience of the IITB and the Monash supervisor(s) support the proposed project**

Wenyi yan - research interests include mechanical behaviours of advanced materials, biomechanics, fracture, fatigue and wear.

Shivasubramanian Gopalakrishnan – Research interests in numerical methods, data sciences, parallel computing and algorithms

### **What is expected of the student when at IITB and when at Monash?**

*The student at IIT Bombay will learn the techniques in numerical methods, high performance computing and machine learning.*

*At Monash the student will focus on the application area of Additive Manufacturing.*

### **Expected outcomes**

*The research outcome from the PhD study should lead to high quality publications and assist the development and application of additive manufacturing.*

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

*This project aims to develop the next generation machine learning techniques to computationally model the process of additive manufacturing.*

### **Potential RPCs from IITB and Monash**

*RPC at IITB: Prof. Ramesh Singh. (Mechanical Engineering). Prof. Asim Tewari (Mechanical Engineering)*

### **Capabilities and Degrees Required**

*Strong background in numerical methods and computer programming  
A degree in mechanical engineering, metallurgy or material sciences.*

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.

**Machine learning, Manufacturing, Mathematical Modelling**