

Rahul-Vigneswaran K

Research Intern

Indian Institute of Technology Hyderabad

Advisor : *Dr Vineeth N Balasubramanian*

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RESEARCH INTERESTS

I seek to solve theoretical machine learning problems using ideas from optimization and statistics.

Major Interests

Computer Vision, Generative Adversarial Networks (GANs)

Others

Convex Optimization, Data-driven approaches (DMD), Computational Design

EDUCATION

Amrita University

Bachelor of Technology in Mechanical Engineering - CGPA: (8.34/10)

Kerala, India

Jul'15 - Jul'19

RESEARCH EXPERIENCE

Indian Institute of Technology Hyderabad - Research Intern

India

Advisor : *Dr Vineeth N Balasubramanian*

July'19 - Present

- Worked on understanding the various properties of loss landscapes of Deep Neural Networks through the lens of statistical tools, to name a few - Hessian's Eigen Spectrum (Hessian Decomposition), PAC-Bayesian, fluctuation-dissipation. Along the way, explored its unique inherent properties like mode connectivity, flatness, induced noise and how they affect the generalization properties for classification tasks.
- Worked on explaining the success of state-of-the-art pruning techniques like Lottery Ticket Hypothesis and why initialization plays a significant role in its success.
- Worked on setting a theoretical base for continual lifelong learning. Followed by gaining insights by looking at catastrophic forgetting in terms of loss landscape and ways these insights can help the community understand the nature of continual learning better in order to formulate better algorithms for it.

★ Work under review for **IJCAI'20**.

Centre for Computational Engineering & Networking (CEN) - Research Intern

India

Advisor : *Dr Soman KP*

Jun'18 - Jun'19

- Worked on ways to make algorithms learn with limited labeled data. Applied Deep Learning in Intrusion Detection Systems for Cyber Security.
- Worked on understanding the mode collapse issue in Generative Adversarial Networks (GANs). Explored several other applications of GANs' which include super-resolution and sound to image translation.
- Worked on model order reduction techniques and Dynamic Mode Decomposition (DMD) for shape optimization, especially in ship hulls.

★ Published 4 works in **SCOPUS** indexed conferences.

Amrita Center for Cyber Security Systems & Networks - Research Intern

India

Advisor : *Dr Prabharan Poornachandran*

Jun'17 - Apr'18

Mechatronics & Intelligent Systems Research (MISR) Lab - Research Intern

India

Advisors : *Dr Pramod Sreedharan & Dr Ganesha Udapa*

Aug'16 - Nov'16

Ammachi labs - Research Intern

India

Advisors : *Mr Vishnu Rajendran S & Mr Akshay Nagarajan*

Apr'16 - Aug'16

SELECTED PUBLICATIONS[†]

1. **Rahul-Vigneswaran, K.**, Sachin-Kumar, S., Mohan, N., & Soman, K. P. (2019, October). **Dynamic Mode Decomposition based feature for Image Classification**. In *TENCON 2019-2019 IEEE Region 10 Conference (TENCON)* (pp. 745-750). IEEE. [\[Paper\]](#)

SELECTED RESEARCH PROJECTS[‡]

Incremental Loss Landscape

Jan'20 - Present

Advisor : [Dr Vineeth N Balasubramanian](#), IIT Hyderabad

- Explored the idea of Data-driven shape optimization, especially in ship hulls.
- Used Proper Orthogonal Decomposition based model order reduction approach and Dynamic Mode Decomposition to reduce the simulation time of turbulent flow.

Layerwise Hessian Analysis

July'19 - Jan'20

Advisor : [Dr Vineeth N Balasubramanian](#), IIT Hyderabad

- Explored the idea of Data-driven shape optimization, especially in ship hulls.
- Used Proper Orthogonal Decomposition based model order reduction approach and Dynamic Mode Decomposition to reduce the simulation time of turbulent flow.

★ Work under review for **IJCAI'20**.

Shape Optimization using DMD and POD

Dec'18 - Apr'19

Advisors : [Dr Soman KP](#) & [Dr Gopalakrishnan EA](#), CEN

- Explored the idea of Data-driven shape optimization, especially in ship hulls.
- Used Proper Orthogonal Decomposition based model order reduction approach and Dynamic Mode Decomposition to reduce the simulation time of turbulent flow.

Intrusion Detection Systems

Jun'18 - Aug'18

Advisors : [Dr Soman KP](#) & [Dr Prabakaran Poornachandran](#), CEN

[\[Code\]](#) [\[Paper\]](#)

- Implemented and analyzed Deep and Shallow Neural Nets in the Cybersecurity use case of Intrusion Detection Systems (IDS).
- Analyzed and studied various state-of-art implementations of Host and Network-based Intrusion Detection Systems (IDS).

★ Work accepted at a **SCOPUS** indexed conference held at IISC Bangalore.

ACADEMIC PROJECTS

Learning with limited labelled Data

Dec'18 - Jun'19

Advisors : [Dr Soman KP](#) & [Mr Sachin Kumar S](#), CEN

- Conducted a detailed study on the existing techniques used for learning with limited labelled data.
- Explored non-conventional techniques for efficiently learning a distribution with low-resource.
- Used Dynamic Mode Decomposition (DMD) to extract the dominant features of images for classifying with limited labelled data.

★ Accepted for an oral presentation at **TENCON'19**.

Trace metal analysis of Pre-flood and Post-flood drinking water in Kerala

Oct'18 - Dec'18

Advisor : [Ms Geena Prasad](#), Amrita University

- Conducted a detailed study on various contents of the water samples, especially trace metals, which were collected Pre and post to a Flood in the state of Kerala.

[†]For full list of publications, kindly check the website.

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RELEVANT MOOCs AUDITED

Optimization	Convex Optimization: Stanford (Stephen P. Boyd)
Machine Learning	Machine Learning: Stanford (Andrew Ng), CNN: Stanford (Fei-Fei Li)
Others	Linear Algebra: MIT (Gilbert Strang)

REFERENCES

1. *Dr Vineeth N Balasubramanian*, Head of Department - Department of Artificial Intelligence / Associate Professor - Department of Computer Science and Engineering, Indian Institute of Technology, Hyderabad - India
2. *Dr Soman KP*, Head, Centre for Computational Engineering and Networking (CEN) - India