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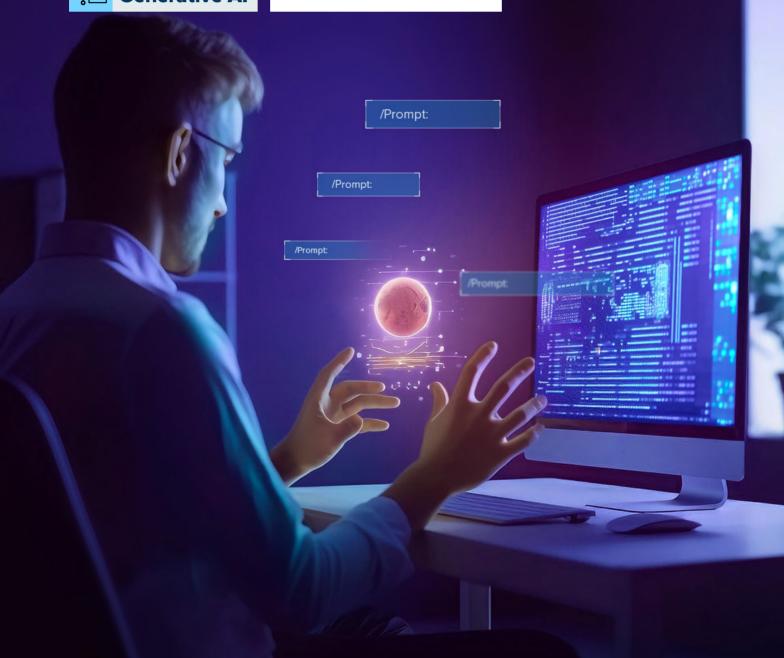
### upGrad

Master of Science in

# Machine Learning & Artificial Intelligence



**Duration 18-21 months** 



### The Era Of Generative Al



The world is at the cusp of Generative AI rapidly changing the world as we know it. At upGrad, we've always believed in imparting learners the skills necessary to thrive in the fast-evolving world of technology. We are hence quite thrilled to pioneer Generative AI as an elective in the Master of Science in Machine Learning & Artificial Intelligence.

With this key inclusion of Generative AI, learners will delve deeper Into the fascinating realm of using Data Science to build practical applications like conversational AI chat bots, Image creators, and content recommenders amongst others, to solve real-world challenges. So dive into this brave new world of Generative AI and Large Language Models with us, and watch yourself transform into a 10x Data Scientist.

"IIIT Bangalore prides itself in constantly updating cutting-edge topics to its curriculum. Our faculty has shaped this exciting Generative Al elective along with upGrad's industry experts, thus ensuring both academic rigour as well as incorporating the latest advancements in tech"

Dr. V. Sridhar, Head-Faculty, IIITB

"As an organisation that asks ask professionals to stay updated with the latest skills, we had to be one of the first to teach Generative AI. With this move, we are excited to witness the impact that Generative AI will have on the future, as well as the value our learners will bring to the field with this essential skill."

Mayank Kumar, Co-founder & MD upGrad

# About upGrad, IIITB, and LJMU, UK

upGrad has delivered over 20 million hours of learning, delivering programs by collaborating with universities across the world including IIIT Bangalore and Golden Gate University, among others

Online education is a fundamental disruption that will have a far-reaching impact. **upGrad** was founded taking this into consideration. upGrad is an online education platform to help individuals develop their professional potential in the most engaging learning environment. Since inception, upGrad is focussed on helping working professionals in their bid to learn, grow and move up in their career through a wide-range of programs designed to improve their expertise.

IIITB is a renowned university offering programs specialising in data science, machine learning and artificial intelligence. IIITB's faculty bring with them an average of 15 years of experience. The faculty covers the conceptual depths of topics such as Data Science, Machine Learning and AI, and Big Data Analytics. These will be complemented by industry relevant case studies from major industry verticals by industry leaders with 10+ yrs of experience from upGrad's industry network. The Executive Diplomas in DS and ML has been developed with the experienced faculty of IIITB in collaboration with Industry experts & upGrad to bring you cutting edge-curriculum with industry relevance. The strong placement network, industry mentorship and the credibility of this Executive Diploma from IIITB will provide you with just the right push to accelerate your career in Machine Learning and AI!

With a heritage that stretches back to **Liverpool John Moores University** UK is now one of the largest and well-established universities in the UK. It has been ranked in the Top 100 World Young Universities & Top 50 in the UK by Student Satisfaction. There are 5 Faculties within the university which are: Business & Law, Arts, Professional & Social Studies, Health, Science, Engineering & Technology. The university is well regarded for its esteemed faculty & teaching as well as research & also for student satisfaction. With an M.Sc. from this university, you are sure to be able to access global job opportunities.

### Program Highlights



# top reasons why you should consider this program



### Future-Ready Curriculum

Master In-Demand and Trending Competencies



### Personalised Learning Experience

Learning Experience Tailored to Your Needs



#### **Specialisations**

Specialise in Two In-Demand Machine Leaning Specialisations



#### **In-Demand Tools**

80+ Industry Tools, Languages, Libraries



### Outcome-Driven Learning Experience

Personalised Portfolio-Building Support and Career Preparation Sessions



### **Leading Experts**

Decorated Faculty and Top Industry Practitioners



### **Golden Learning Ratio**

Perfect Blend of Mathematics, Technology, and Business Understanding



### Hands-on Learning

Solve 30+ Domain-Focused
Assignments and
Case Studies

#### **Double Accreditation and Alumni Status**

Get certified by IIITB and LJMU, and gain double alumni status with these prestigious institutions on successful completion of program

### Live LJMU Classroom Hour

Live classroom session for dissertation related queries

#### **LJMU Immersion**

Option to Participate in On-Campus Immersion at LJMU, UK



**Prof. Dhiya Al-Jumeily** The Head and Professor - AI, LJMU



A senior member of the IEEE, a chartered IT professional, and a member of the UK Higher Education Academy



Faculty - Computer Science, LJMU

**Doctor Atif Waraich** 

JOHN MOORES UNIVERSITY

**LIVERPOOL** 

A senior faculty of engineering and technology at LJMU with multiple publications in the healthcare field



Applied Mathematics, LJMU Was the Chairman of Industrial Mathematics at LJMU in 1996 and Head of Graduate School in 2002

Head of Mathematics (retired) -

**Doctor Paulo Lisboa** 

LIVERPOOL JOHN MOORES



Technology - LJMU

**Dr Ahmed Kaky** 

Technology - LJMU

Faculty of Engineering and

Dr Manoj Jayabalan

LIVERPOOL **JOHN MOORES** 



Faculty of Engineering and



LIVERPOOL

**JOHN MOORES** 



He has received his PhD from IIT-KGP. His main areas of research are IoT and Wireless

Access Network.

Professor, IIITB

**Dr. Debabrata Das** Director of IIITB





Prof. Srinivasaraghavan has a PhD in Computer Science from IIT-K and 18 years of experience with Infosys

**Prof. G. Srinivasaraghavan** 



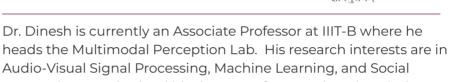


### Audio-Visual Signal Processing, Machine Learning, and Social Computing. He obtained his doctorate from Ecole Polytechnic

Dr. Dinesh Babu Jayagopi

Federale Lausanne (EPFL), Switzerland.

Professor, IIITB



**Chandrashekar Ramanathan** Professor & Dean (Academics)



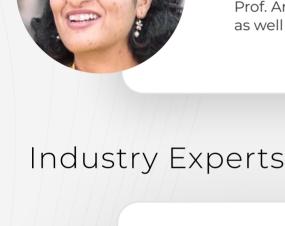
### has been working in the field of Computing for over 25 years in various capacities across industry and academia.



Tricha Anjali Ex-Associate Dean

Prof. Anjali has a PhD from Georgia Institute of Technology

as well as an integrated MTech (EE) from IIT Bombay.



Having worked with Microsoft as a Senior Data Scientist, he is an alumnus of IIT Kharagpur with 10+ years of experience in a

CEO, Gramener A gold medallist from IIM Bangalore, an alumnus of IIT Madras and London Business School, Anand is among the top 10 data scientists in India with 20 years of

Infosys

Principal



splunk>



### Microsoft

Ex-Senior Data Scientist

Data Science domain

Abhishek Vijayvargia

Senior Data Scientist



**Anand** 

CEO

Faculty

**IIT MADRAS** 

Head of Generative AI

Microsoft

Release Manager

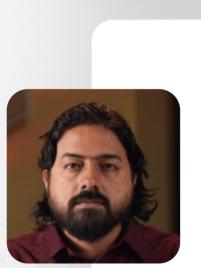
experience.





BCG

**Ex-Consultant** 



# **Manish Shukla**

Leading cutting-edge GenAl platform development at NatWest Group. Expertise in OpenAI products and MLOps for optimisation of operational efficiency and seamless project delivery with high user satisfaction.

**NOSIA** 

Release Manager



**Deependra Singh** Network 18 VP & Head of Data Science Over 15 years of experience in leading analytics practices, data science, deep learning, and AI product development. Successfully led teams at Junglee Games, American Express Digital Business, and National Insurance Company, pioneering key projects like the

analytics engine for the GOI PMJAY policy. Respected speaker at



### top educational institutes like IMT Hyderabad, BIT Mesra, and NMIMS.





### Senior Engineering Manager, Hotstar Sajan has extensive experience in the field of ML, Big Data, Data Science, and Al.

Sajan Kedia

Sr. Engineering manager



Machine Learning

Research Engineer





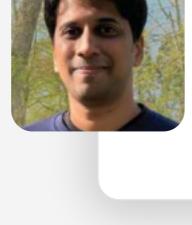
Machine Learning

Engineer

**Myntra** 

Flipkart 🚅

Ex-Analytics Lead



Analytics Lead, Zalando Mirza is a veteran professional with 10+ years of experience in application of data science, machine

zalando

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Team Lead - Product

Sr. Engineering

manager



**NMIMS** 

Marketing Analytics

# Assignments and Case Studies from 12+ In-Demand Business Domains



Retail &
Ecommerce
ETL Pipelining with Spark



Media &
Entertainment
Data Analysis using SQL



**Transportation**EDA
using Python



**Education**Model Selection
using Sklearn



**Civil Engineering**Classification using
CNNs



**HR** Semantic Classification using Word2Vec



**Manufacturing**Regularisation using
Sklearn



**Healthcare**Classification using
Sklearn



**Law** RAG using LangChain



**InfoSec**Feature Engineering using Sklearn



**FMCG**Big Data Analysis using Spark



**BFSI**Sequence Data Prediction
using RNN

### Your Program Journey

### Phase 0

Math and Programming Bootcamp (12 weeks)

### Phase I

### Core Curriculum

(28 weeks, 15 IIITB credits)



### Phase II

### Specialisation Tracks

(22 weeks, 14 IIITB credits)



# **Phase III**Capstone

(4 weeks, 7 IIITB credits)



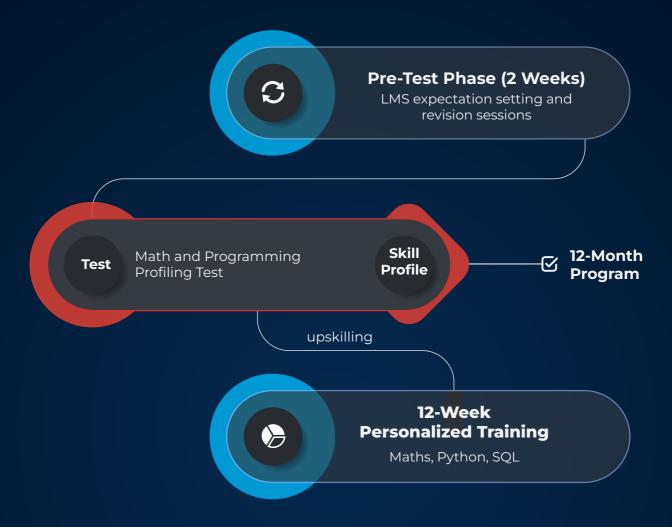
### **Phase IV**

### Thesis Dissertation

(6 months, 70 LJMU credits)

### Applied Math and Programming Bootcamp

Personalise the initial 3 months of the program to your profile



Topics: Sets, Combinatorics, Basics of Probability, Conditional Probability, Descriptive Statistics, Functions, Vector Algebra, Derivatives, Integrals, Coding Environments, Variables, Data Types, Syntax, Conditionals, Loops, Functions, Lists, Sets, Tuples, Dictionaries, Introduction to MySQL, Basic SQL Querying

Marks Structure: Total marks - 100

- Section A 40 marks (basic mathematics) Section B 60 marks (basic programming)
- Passing marks 25 marks in section A & 35 marks in section B

No added cost to be paid for the bootcamp We make sure that you are well-equipped to draw the most benefit from the program!

### **Core Curriculum**

The core phase of the curriculum will equip you with the most up-to-date and industry-relevant skills and technologies for data science and machine learning such as programming and mathematics, data analysis tools and techniques, cloud computing and big data analytics, and foundational topics in machine learning, deep learning, and natural language processing.

### **Topics**

### Advanced Mathematics for Data Science and Machine Learning

Master essential mathematical concepts to understand how to work with large amounts of data and train efficient machine learning models

- Conditional Probability and Probability Distributions
- Advanced Linear Algebra and Linear Transformations
- **Multivariate Calculus**

### Wrangle real-world data using universal programming languages such as

Advanced Programming for Data Science and Machine Learning

Python and SQL, and use GenAl for generating and debugging code faster

- GenAl for Coding and Problem-Solving
- Object-Oriented Programming
- Python Data Science Libraries
- Database Design and SQL Querying with MySQL
- Introduction to NoSQL Databases

### **Data Analysis and Exploration**

Implement industry-standard statistical methods using tools such as Python, Tableau, and Power BI to analyse data and derive business insights

- Data Analysis with Python
- Exploratory Data Analysis
- Inferential Statistics and Hypothesis Testing
- Data Analysis and Visualisation with Power BI and Tableau

### **Cloud Computing and Big Data Fundamentals**

Take your data processing and analysis workflows to the cloud and work with larger amounts of data to derive enterprise-scale business insights

- Cloud Computing with AWS, GCP, Microsoft Azure
- Big Data Analysis with PySpark

### **Foundations of Machine Learning**

Train industry-standard machine learning models to automate insight generation and predict business metrics behaviour

- Machine Learning Paradigms
- **Linear and Logistic Regression**
- K Nearest Neighbors
- Regularisation and Hyperparameter Tuning
- Decision Trees and Ensembles
- **Clustering Models**

### **Deep Learning and Natural Language Processing** Build and train deep neural network models for different kinds of business

data such as images and sequences **Artificial Neural Networks** 

- Convolutional and Recurrent Neural Networks
- Lexical, Syntactic, and Semantic Processing
- **Deployment Fundamentals**

### Share and deploy your insights and machine learning models so that other collaborators can work with your contributions

**Containerisation and Deployment Tools** 

- **Version Control**
- **Projects**

### Querying with SQL Analyse Spotify music data for targeted

data for risk assessment Exploratory Data Analysis Analyse NYC taxi operations for efficient

recommendations or NDAP insurance

taxi positioning or US beer production data for better brewery operation management

Big Data Analysis Analyse Mercari products data for better targeted recommendations or customer interaction data to enhance customer

Linear Regression Predict household energy consumption

engagement

increase power consumption efficiency or parcel delivery time for Porter using historical delivery data for better planning and management Deep Learning Predict stock prices of Microsoft, Amazon, Google, IBM, using their

historical stock price variations or temperature/pressure readings in

Morocco using historical weather data

using appliance energy readings data to

Google

**Microsoft** 



amazon



mercari





**Spotify** 

### **Tools**



















PySpark<sup>3</sup>





NumPy pandas



























### **MLOps Specialisation**

The machine learning operations (MLOps) specialisation of the curriculum will equip you with core in-demand and industry relevant skills and technologies essential for ML engineers such as advanced machine learning methods, modern deep learning architectures, real-time data processing and end-to-end data pipeline creation and monitoring, and model pipelining and monitoring at scale.

### **Topics**

### **Advanced Machine Learning**

Train advanced industry-oriented machine learning models for enhanced predictive power and stronger business insight generation

- **Support Vector Machines and Naive Bayes**
- Feature Engineering and Model Selection
- Dimensionality Reduction
- Time Series Analysis
- Association Rule Mining and Recommendation Systems
- Explainable AI

Advanced Deep Learning and Generative Al

Design and train advanced industry-standard deep learning architectures, and master core AI principles such as attention mechanisms, transformers, and prompt engineering

- Advanced CNN Architectures
- LSTMs and GRUs
- Transfer Learning Techniques
- Encoder-Decoder Architectures and Seq2Seq
- Machine Translation
- **Attention Mechanisms and Transformers**
- Fundamentals of Generative AI and Prompt Engineering
- Computer Vision, Variational Autoencoders, Generative Adversarial **Networks**
- Data and Model Security Principles

### Large-Scale Data Pipelining

Build complete end-to-end data pipelines and automate them to generate both batch-wise and real-time business insights

- **End-to-End Data Pipelining Fundamentals**
- Pipeline Automation with AWS Lambda, GCP Functions, and Azure Automation
- Data Monitoring with Amazon CloudWatch, Google Cloud Monitoring, and Azure Monitor
- Feature Stores and Vector Databases
- Real-Time Analytics with Flink, Kafka, and Spark Streaming
- Real-Time Analytics with Amazon Kinesis, Google Cloud Pub/Sub and DataFlow, Azure Stream Analytics and Event Hubs
- **Multicloud and Hybrid Cloud Operating Principles**

### **Machine Learning Model Pipelining** Build end-to-end industry-ready ML model pipelines and design their

**Model Pipelining Principles** 

functional behaviour such as training and inference

- **Scheduling and Triggers**
- Parallel Model Training and Real-Time Model Serving Data and Model Versioning
- Model Monitoring and System Design

### **Projects** Feature Engineering and Model Selection

- Predict fraudulent insurance claims using the Mendeley farmers insurance claims dataset or network intrusion events using historical network activity data Semantic Classification
- Fake News Detection, Job Role Classification Real-Time Data Analytics: Develop a

real-time analytics pipeline for ecommerce

- data to enhance customer experience or a real-time patient health monitoring system for faster corrective actioning Simulate and Retrigger Model Training **Pipeline**
- **Tools**



### 





















































Stream Analytics















**dbt** 



kubernetes







### **Generative AI Specialisation**

The generative artificial intelligence (GenAI) specialisation of the curriculum will equip you modern AI technologies and methods, particularly generative AI technologies, essential to data scientists and Al specialists, such as advanced machine learning methods, modern deep learning architectures, advanced prompt engineering and generative Al system design, information retrieval and retrieval-augmented generation, large language model (LLM) deployment, advanced computer vision and 3D vision, GenAl optimisations, and Al ethics.

### **Topics**

### **Advanced Machine Learning**

Train advanced industry-oriented machine learning models for enhanced predictive power and stronger business insight generation

- **Support Vector Machines and Naive Bayes**
- Feature Engineering and Model Selection
- Dimensionality Reduction
- Time Series Analysis
- Association Rule Mining and Recommendation Systems
- Explainable Al

### Advanced Deep Learning for Generative Al

Design and train advanced industry-standard deep learning architectures, and master core AI principles such as attention mechanisms, transformers, and prompt engineering

- Advanced CNN Architectures
- LSTMs and GRUs
- Transfer Learning Techniques
- Encoder-Decoder Architectures and Seq2Seq
- Machine Translation
- Attention Mechanisms and Transformers
- Fundamentals of Generative AI and Prompt Engineering
- Computer Vision, Variational Autoencoders, Generative **Adversarial Networks**
- **Data and Model Security Principles**

### **GenAl System Design**

Design and orchestrate generative AI systems to leverage the power of generative AI models and transform business operations

- Advanced Prompt Engineering and GenAl System Design
- **Prompting Multimodal Models**
- LLM Frameworks such as LangChain and LLaMa Index
- **Data Security and Governance**
- **AI Ethics**

### **Advanced Generative Al**

Develop AI-based cutting-edge industry-level systems for greater business efficiency such as retrieval-augmented generation (RAG) systems and multimodal GenAl model prompt engineering

- Information Retrieval Principles **Embeddings and Vector Databases**
- RAG Architectures
- Agentic Systems and Multi-Agent Systems
- Advanced Multimodal GenAl Models ■ LLM Deployment

Advanced Computer Vision and 3D Vision

**GenAl Optimisations** 

### **Projects** Feature Engineering and Model Selection

the Mendeley farmers insurance claims dataset or network intrusion events using historical network activity data Semantic Classification

Predict fraudulent insurance claims using



identify prevalent sentiments and themes

to improve product offerings and enhance customer satisfaction or ChatGPT customer feedback to derive actionable insights for business improvement RAG Develop an RAG system to transform Long

Beach County Municipal meetings transcripts into actionable insights for

better organisational communication and decision making or historical legal documentations to optimise legal workflows **Tools** 











**Hugging Face** 











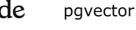






































### **Capstone Projects**

### Capstone that Adapts to Your Preference

#### Infuse our Capstone with Your Data

Modify existing projects as per your industry data and problems

#### **Bring Your Own Capstone**

Work on a completely novel project of your choice and solve problems that excite you

#### **Pre-Designed Industry Capstone**

Choose one of our existing projects that cover in-demand trending industry domains

### Bring Your Own Capstone

Design your own capstone project relevant to your domain and interest, and get feedback throughout your capstone stages



Identify a real-world problem relevant to your domain



Source datasets aligned with your business problem



Design and implement your solution



Document your efforts and present your findings



Continuous expert feedback at every step of capstone

### **Thesis Dissertation**

The thesis dissertation phase of your program experience focuses on working on your master's thesis in the domain of data science, machine learning, and artificial intelligence, so that you can truly master this high-impact domain.

### **Topics**

#### Introduction to Research

Understand different types of research, formulate your research question, and learn to study and cite research papers

- Aspects of Research and Formulating a Research Question
- Understanding Various Research Designs
- Reading and Citing Research Papers
- Research Project Management
- Report Writing and Presentation Design
- Scientific Ethics in Research

#### Sample Thesis Topics

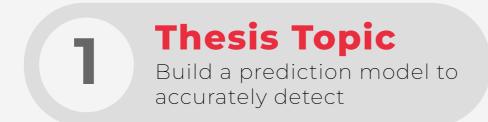
Study sample thesis topics to get a concrete understanding of what a research thesis entails

- Investigate dietary patterns and metabolite fingerprints of takeaway (fast) food consumers using PCA and clustering methods
- Investigate a diagnosis of eye diseases using imaging ophthalmic data
- Structure medical images with information geometry
- Using social media feed to place tweets regarding natural disasters on a map
- Preventing credit card fraud through pattern recognition
- Developing a recommender system for a media giant
- Risk modelling for financial activities and investment banking
- Using social media feed to place tweets regarding natural disasters on a map

### **Final Thesis Report**

Submit your in-depth research work in a final thesis report and present your findings

### Research of our learners A Glimpse



### **Abstract**

#### **Background**

Damage to peripheral nerves causes Peripheral neuropathy (PN). Patients complain of pain, numbness and loss of balance. If not identified early and treated adequately, PN could progress rapidly and lead to fatal complications. defining factors to classify PN accurately has remained challenging. This research proposes a model to detect and classify PN into axonal, demyelinating, mixed and normal types from clinical and nerve conduction study (NCS) data using the Random Forest algorithm.

#### Data and methods:

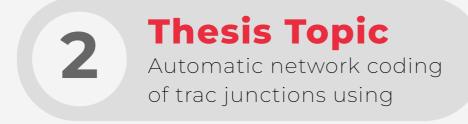
Clinical and NCS data of 304 Indian patients, 229 a ected by PN and 75 normal was collected with ethical approval from Kauvery hospital, Chennai. Exploratory data analysis and the Random Forest Algorithm was used to build a model.

#### Results:

Random Forest model was able to predict and classify PN with an accuracy of 96%. In axonal cases, sensory and motor nerves showed a drop in amplitudes of greater than 40% compared to normal patients. Reduced amplitude (>40%) in motor nerves of lower limbs and missing values (>90%) in sensory nerves of lower limbs identified axonal PN. Delayed onset latency (>40%) in motor nerves of upper limbs, decreased conduction velocity (>60%) in sensory nerves of upper limbs and increased onset latency (>40%) in F-waves of upper limbs delineated the demyelinating type. Median ages of patients were mixed (65), demyelinating (51) and axonal (61). Axonal (18.75% was significant in diabetic patients and demyelinating (14.8%) in non-diabetic patients. Both axonal and mixed (16.78%) types were greater in hypertensive patients, and demyelinating (17.11%) type was higher in patients without hypertension. Reflex was depressed more in mixed (17.49%) than axonal (15.51%) and demyelinating (11.89%). Mixed (37.06%) type showed more in-sensitivity to pin-prick than axonal (29.37%) and demyelinating (24.48%) types. Mixed (45%) patients tested positivefor Romberg's test more than axonal (31%) and demyelinating (21%). Mixed (34.65%) patients complained of numbness more than axonal (23.62%) and demyelinating (26.77%) types.

### Conclusion:

Random forest algorithm identified and classified PN well using clinical and NCS features. Clinical features (age, diabetes, hypertension, reflex, Romberg's test, numbness and perception to pin-prick) were useful in detecting PN. Nerve conduction study features (amplitude, onset latency, conduction velocity, F-wave response and missing sensory values) were instrumental in classifying PN. Reduced amplitudes of sensory and motor nerves identified the axonal condition. Delayed onset latency and low conduction velocities along with missing and delayed F-wave responses identified the demyelinating type.



### **Abstract**

Before any traffic simulation can be performed, the network of roads and junctions is modeled. Assigning attributes to the roadway network, such as the road length and width, the junction type, number of arms, and lanes, is a crucial task while building the network. This research is an attempt to develop an efficient traffic junction classifier using machine learning and deep learning algorithms on satellite images. Three junction categories, Priority, Roundabout, and Signal, are considered for analysis. As this is a novel research idea, the required image dataset of junctions is created using the Google Maps API. By using robotic process automation, the downloading of the images is automated. Two approaches are taken to build the classifiers: a machine-learning approach and a deep-learning approach. The machine learning approach is split into two phases: the feature extraction phase and the classification phase. In the feature extraction phase, a Histogram of Oriented Gradients (HOG) descriptors is used to extract features from the images. Furthermore, in the classification phase, several classification algorithms are applied to the HOG features to build classifiers. In the deep-learning approach, taking advantage of powerful pre-trained models and transfer learning, a Convolutional Neural Network (CNN) is developed for classifying the junctions. The models are evaluated, and in the end, a comparison between the various classification models is performed. The results showed that the CNN classifier modeled had the best accuracy and AUC compared to the other models with scores of 0.81 and 0.94 respectively. Among the machine learning models that were trained on the HOG features, the Extreme Gradient Boosting model has the best accuracy of 0.62. The ultimate aim of this work is to use this junction-classifier model on real projects to aid the process of finding the type of junctions and reduce the effort and time required to model the roadway networks.

### Build A Strong Portfolio



#### Commits

Demonstrate consistency, collaboration, and coding discipline

#### Code

Showcase well-documented repositories

#### Projects

Host end-to-end DS/ML/AI projects that highlight real-world problem-solving

#### **GitHub helps with**

- ✓ Validating coding skills
- Showing growth and consistency
- Being interview-ready for Tech roles

### kaggle

#### Kernels

Highlight data processing and EDA methodologies

#### Ranking

Evaluate and reflect global standing among data science practitioners

#### Competitions

Demonstrate problemsolving under tight constraints

#### Kaggle helps with

- ☑ Building credibility in data science circles
- Applying learning to real datasets
- ✓ Speaking confidently in Tech interviews

### Linked in

#### Headline

Concise summary of goals, competencies, and professional identity

#### Summary

Engaging overview of learnin and career journey

#### Projects

Showcase practical experience, outcomes, and skill application

#### LinkedIn helps with

- Improving visibility with recruiters
- Positioning better for job openings
- Networking with peers and mentors in the field

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### Enrol in 4 small steps, Then take a giant leap.



### **Eligibility Criteria**

Bachelor's or Master's Degree or its equivalent in any discipline with minimum 50% aggregate mark or equivalent CGPA.



Q upgrad.com

### For further details, contact -

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Asia Pacific except India:

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**465 6232 6730** 

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