

Artificial Intelligence (AI) and Automation Master's Program in Computer Engineering

Objective:

The Artificial Intelligence (AI) and Automation Training Program aims to provide students in the Computer Engineering Master's Program with a solid foundation in AI, covering advanced topics. The program also integrates essential skills such as ethics, project management, and employment preparation.

Weeks 1-2: Foundations in Python, Mathematics, and Exploratory Data Analysis (EDA)

- **Week 1: Foundations (Python, Maths)**
 - **Content:** In-depth exploration of the Python language and essential mathematical concepts.
 - **Skills and Libraries:**
 - Advanced programming in Python.
 - Data manipulation with NumPy and pandas.
 - Mathematical concepts for ML and DL.
 - **Exercises:** Practical projects in Python, integration of mathematics into real-world problems.
 - **Online Resources:** Coursera Python for Everybody, Khan Academy - Math, NumPy Quickstart Tutorial, pandas Documentation.

- **Week 2: Exploratory Data Analysis (EDA) and Basics of Machine Learning with scikit-learn**

- **Content:** EDA techniques, data understanding, cleaning, regression, and classification algorithms with scikit-learn.
 - **Skills and Libraries:**
 - Mastering EDA to understand data.
 - Applying scikit-learn for simple ML problems.
 - **Exercises:** Using EDA to understand data, applying scikit-learn to solve machine learning problems.
 - **Online Resources:** Coursera Machine Learning by Andrew Ng, Kaggle, GitHub, scikit-learn Documentation.

Weeks 3-4: Advanced Machine Learning and Model Optimization

- **Week 3: Advanced Machine Learning with scikit-learn**

- **Content:** Advanced ML techniques, ensemble models, artificial neural networks, deep learning. Using scikit-learn for advanced tasks.
 - **Skills and Libraries:**
 - Applying advanced models with scikit-learn.
 - Advanced data preprocessing techniques.
 - **Exercises:** Using advanced models to solve complex problems.
 - **Online Resources:** Advanced ML courses, Research Articles, Model Optimization Tutorials.

- **Week 4: Model Optimization and Hyperparameter Tuning**

- **Content:** Model optimization techniques, hyperparameter tuning, model interpretability.
 - **Skills and Libraries:**
 - Applying model optimization techniques.
 - Mastering hyperparameter tuning to improve performance.
 - **Exercises:** Optimising previously created models, adjusting hyperparameters.
 - **Online Resources:** Research Articles, Model Optimization Documentation.

Week 5: Version Control with Git and GitHub, Basic Deep Learning

- **Content:** Version control with Git and GitHub. Introduction to Deep Learning, neural network concepts, using fundamental libraries (TensorFlow, PyTorch).
 - **Skills and Libraries:**
 - Advanced use of Git for version control.
 - Understanding neural network architectures.
 - Implementing basic models with TensorFlow and PyTorch.
 - **Exercises:** Using Git for version tracking, creating and training basic models.
 - **Online Resources:** Git and GitHub Courses, TensorFlow Documentation, PyTorch Documentation.

Week 6: Advanced Deep Learning, Advanced Generative AI, Advanced Computer Vision, and Practical Projects

- **Content:** Advanced Deep Learning techniques, model optimization, hyperparameter tuning, and an introduction to Advanced Generative AI.
 - **Skills and Libraries:**
 - Advanced use of TensorFlow and PyTorch.
 - Applying advanced Deep Learning techniques to complex problems.
 - Understanding the basics of Generative AI.
 - **Exercises:** Creating advanced models, applying Deep Learning techniques, introduction to Generative AI.
 - **Online Resources:** Advanced Deep Learning Courses, Research Articles, Model Optimization Tutorials, Introduction to Generative AI.

Week 7: Computer Vision - Basic

- **Content:** Introduction to Computer Vision, basic concepts, image processing.
 - **Skills and Libraries:**
 - Understanding the basic principles of Computer Vision.
 - Using libraries such as OpenCV for image processing.
 - **Exercises:** Implementing basic Computer Vision techniques.
 - **Online Resources:** Computer Vision Courses, OpenCV Documentation.

Week 8: Computer Vision - Advanced

- **Content:** Advanced techniques in Computer Vision, object detection, image segmentation.
 - **Skills and Libraries:**
 - Applying advanced Computer Vision techniques.
 - Using pre-trained models for object detection.
 - **Exercises:** Implementing object detection with OpenCV, advanced image segmentation.
 - **Online Resources:** Advanced Computer Vision Courses, OpenCV Documentation, PapersWithCode.

Week 9: Advanced Generative AI

- **Content:** In-depth understanding of advanced Generative AI models, using GANs (Generative Adversarial Networks) and sequence models.
 - **Skills and Libraries:**
 - Advanced implementation of GAN models.
 - Application of sequence models for generation.
 - **Exercises:** Creating advanced GAN models, generating sequences.
 - **Online Resources:** Specialised courses on Generative AI, Research Articles.

Weeks 10-11: Big Data and Artificial Intelligence

- **Week 10: Introduction to Big Data and its Role in AI**
 - **Content:** Big Data's role in AI, handling massive datasets.
 - **Skills and Libraries:**
 - Handling massive datasets with Apache Spark.
 - **Exercises:** Manipulating massive datasets with Spark.
 - **Online Resources:** Apache Spark Documentation, Hadoop Tutorials.
- **Week 11: Integrating Big Data Solutions into AI Projects**
 - **Content:** Using Big Data frameworks (Spark, Hadoop) for processing large datasets.
 - **Skills and Libraries:**
 - Integrating Big Data solutions into AI projects.
 - **Exercises:** Integrating Big Data solutions into AI projects.
 - **Online Resources:** Tutorials on integrating Big Data into AI.

Weeks 12-13: Model Evaluation, AI Ethics, History and Applications of AI

- **Week 12: Model Evaluation and AI Ethics**

- **Content:** Model evaluation techniques, ethical issues in AI.
 - **Skills and Libraries:**
 - Using model evaluation tools.
 - Understanding ethical challenges in AI development.
 - **Exercises:** Model evaluation, discussions on ethical cases.
 - **Online Resources:** Articles and tutorials on model evaluation, AI Ethics Courses.

- **Week 13: History of AI, Current Applications, and Project Management in AI**

- **Content:** Historical evolution of AI, current applications, project management methodologies.
 - **Skills and Libraries:**
 - Understanding the history of AI.
 - Applying AI in real-world scenarios.
 - Using project management methodologies in AI.
 - **Exercises:** Research on the history of AI, case studies on current applications, creating an AI project plan.
 - **Online Resources:** Books and articles on the history of AI, Case studies on real-world applications, Project Management Guides in AI.

Weeks 14-15: Advanced Projects, Exploring AI Trends, and Program Conclusion

- **Content:** Working on advanced projects, exploring emerging trends in AI.
 - **Skills and Libraries:**
 - Using emerging technologies in AI.
 - Implementing complex projects.
- **Exercises:** Working on advanced projects, exploring the latest trends in AI.
- **Online Resources:** Research articles, online conferences on AI, specialised blogs.

Week 15: Intelligent Robotics, Project Management in AI, and Program Conclusion

- **Content:** Introduction to Intelligent Robotics, integrating AI into robots, project management in AI.
 - **Skills and Libraries:**
 - Understanding concepts of Intelligent Robotics.
 - Applying AI in robotic projects.
 - Using project management methodologies in AI.
- **Exercises:** Exploring Intelligent Robotics projects, project management in AI, program conclusion.
- **Online Resources:** Introductory courses on Intelligent Robotics, Tutorials on AI in Robotics, Project Management Guides in AI.

Note: The content, skills, and online resources may be adjusted based on rapid developments in the field of AI and the emergence of new technologies.