

Integrated Analysis: Gene Expression, Survival, Biomarkers, and Drug Targets

Submitted in partial fulfilment of the required for the award of
Master of Science Degree in Bioinformatics and Data Science

By

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**DEPARTMENT OF BIOINFORMATICS AND DATASCIENCE
SCHOOL OF BIO AND CHEMICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE
UNIVERSITY)**

Accredited with Grade "A++" by NAAC | Approved by AICTE

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April – 2024



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This is to certify that this Project Report is the Bonafide work of
S. YASMIN TABASUM (43739009) who carried out the project entitled
“Integrated Analysis: Gene Expression, Survival, Biomarkers, and
Drug Targets” under my / our supervision from January 2024 to April
2024.

Internal Guide

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Submitted for Viva voce Examination held on _____

DECLARATION

I **S. YASMIN TABASUM** (43739009) hereby declare that the Project Report entitled “**Integrated Analysis: Gene Expression, Survival, Biomarkers, and Drug Targets**” done by me under the guidance of Dr. /Prof./ Mr./Ms. _____ and _____(External) at _____ is submitted in partial fulfilment of the requirements for the award of Masters of Science degree in Bioinformatics and Data Science.

DATE:

PLACE:

SIGNATURE OF THE CANDIDATE

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I am pleased to acknowledge my sincere thanks to Board of Management of SATHYABAMA for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to Dr. -----, Dean, School of ----- and Dr.-----, Head of the Department, Dept. of Bioinformatics and DataScience for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide Dr./Mr./Ms-----for their valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

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ABSTRACT

The approach to undo the molecular complexities underlying lung cancer pathogenesis and therapeutic interventions. Firstly, we conducted a comprehensive differential expression analysis using GEO2R, elucidating key genes dysregulated in lung cancer compared to normal tissue. Subsequent functional analysis using Cytoscape and ClueGO provided valuable insights into the biological processes and pathways implicated in disease progression.

Building upon these findings, we performed survival analysis utilizing Kaplan-Meier plots to assess the prognostic significance of identified genes. This analysis allowed us to stratify patients based on gene expression profiles, uncovering potential prognostic biomarkers essential for patient risk stratification and personalized treatment strategies. Then we used TheMarker to conduct biomarker screening specifically tailored for lung cancer, identifying potential diagnostic and prognostic markers with high specificity and sensitivity. These markers offer promise for early detection and prognosis assessment in clinical settings.

Additionally, we conducted drug target screening using SwissTargetPrediction to identify potential targets for therapeutic intervention in lung cancer. Subsequent molecular docking analysis with the drug doxorubicin assessed the binding affinity of identified targets, offering insights into potential treatment efficacy. Overall, our integrated approach provides a comprehensive understanding of lung cancer biology, from dysregulated gene expression to prognostic biomarkers and potential therapeutic targets.

AIM

To comprehensively investigate the molecular landscape of lung cancer, elucidating dysregulated genes, molecular pathways, and potential therapeutic targets, while also assessing the prognostic significance of treatment modalities, including the drug doxorubicin.

OBJECTIVE

1. Conduct a differential expression analysis using GEO2R to identify genes dysregulated in lung cancer compared to normal lung tissue.
2. Perform functional analysis utilizing Cytoscape and ClueGO to elucidate the biological processes and pathways associated with the dysregulated genes.
3. Utilize the KM plotter to analyze survival plots
4. Explore potential biomarkers and therapeutic targets for lung cancer through integrated analysis of gene expression data and survival outcomes
5. Assess the binding affinity of doxorubicin with potential therapeutic targets identified in lung cancer using molecular docking methods, providing insights into its mechanism of action and therapeutic potential.

MATERIALS:

Geo2R:

GEO2R is an interactive web tool that allows users to compare two or more groups of Samples in a GEO Series in order to identify genes that are differentially expressed across experimental conditions.

Cytoscape:

Cytoscape is an open source bioinformatics software platform for visualizing molecular interaction networks and integrating with gene expression profiles and other state data. Additional features are available as plugins

Cytohubba:

The Cytohubba plugin in Cytoscape was used to identify hub genes from the protein-protein interaction network using the most recent maximal clique centrality approach. The top ten hub genes and their interactions with other molecules are represented by the nodes highlighted in red or yellow.

ClueGO:

ClueGO is a Cytoscape App that facilitates the biological interpretation of large lists of genes and proteins by selecting representative Gene Ontology terms and pathways from multiple ontologies and visualizes them into functionally organized networks.

KM Plotter:

The KM plotter was utilized to estimate the effect of 54 k genes (mRNA, miRNA, protein) on survival in 21 cancer types based on the gene arrays, RNA-sequence or next generation sequencing (for mutation data). Sources for the databases include GEO, EGA, and TCGA.

TheMarker:

TheMarker is an advanced database specializing in therapeutic biomarkers, offering comprehensive coverage of five crucial types essential for drug development. With systematic organization and extensive drug and disease coverage, it provides invaluable insights for researchers and practitioners, facilitated by its integration of AI technology

SwissTargetPrediction:

SwissTargetPrediction is a cutting-edge tool designed to predict potential targets for small molecules. Leveraging sophisticated algorithms and vast datasets, it enables researchers to identify the most probable protein targets that a given compound may interact with. SwissTargetPrediction facilitates drug discovery and development processes, ultimately accelerating the journey from compound identification to clinical application.

Molecular Docking Software (Discovery Studio):

Molecular docking with Discovery Studio offers precise simulations of molecular interactions, crucial for drug design and optimization. Through advanced algorithms and visualization tools, it enables researchers to predict binding poses and affinity between ligands and target proteins, aiding in the rational design of therapeutics. Discovery Studio's efficient workflows streamline the exploration of ligand-receptor interactions, enhancing the efficiency of drug discovery efforts.

METHODS:***Differential Expression and Functional Analysis:***

- For the dataset on Lung cancer, GEO is the source of the GEO dataset.
- After choosing the suitable parameters the complete table was downloaded.
- Genes that were upregulated were pasted in the cytoscape network.
- Build a Biological Network using Biogrid and use cytohubba to analyse the network and identify important nodes based on various topological algorithms to determine the top 10 genes.
- The top 10 genes were pasted in ClueGO and configure ClueGO parameters such as species, Ontology and Statistical settings.
- Run ClueGO analysis to identify enriched functional categories or pathways associated with the selected nodes.

Survival Analysis:

- Kaplan Meier plotter home page was accessed using the following hyperlink <https://kmplot.com/analysis/index.php?p=background>
- Proposed gene/protein (o/p of Ex No 1) ---- was submitted in the pan cancer portal
- Below listed parameters were opted for analysis
- Restriction subtype –All
- Split patients by-Auto select best cut off
- Survival: Overall survival(os)
- Survival: All
- Restrict analysis based on cellular content :All

Biomarker Screening:

- The marker database was retrieved using following link <http://themarker.idrblab.cn/about>
- Top listed Mrna/protein Biomarker relevant to the Lung Cancer data's were retrieved and literature survey was done.

Drug Target Screening and Drug repurposing:

- Disease Lung Cancer associated FDA approved drugs was chosen and smiled notation was retrieved from Pubchem using following link <https://pubchem.ncbi.nlm.nih.gov/>
- Swisstarget home page was accessed using following link <http://www.swisstargetprediction.ch/index.php>
- Predicted the targets (Top five) and drug interaction was analyzed using discovery studio Receptor ligand interaction module.

Results and Discussion

- A total of 23793 genes were found to be differentially expressed between lung cancer samples and normal lung tissue.
- Of these, 35 genes were upregulated, and 23758 genes were downregulated in lung cancer compared to normal tissue.

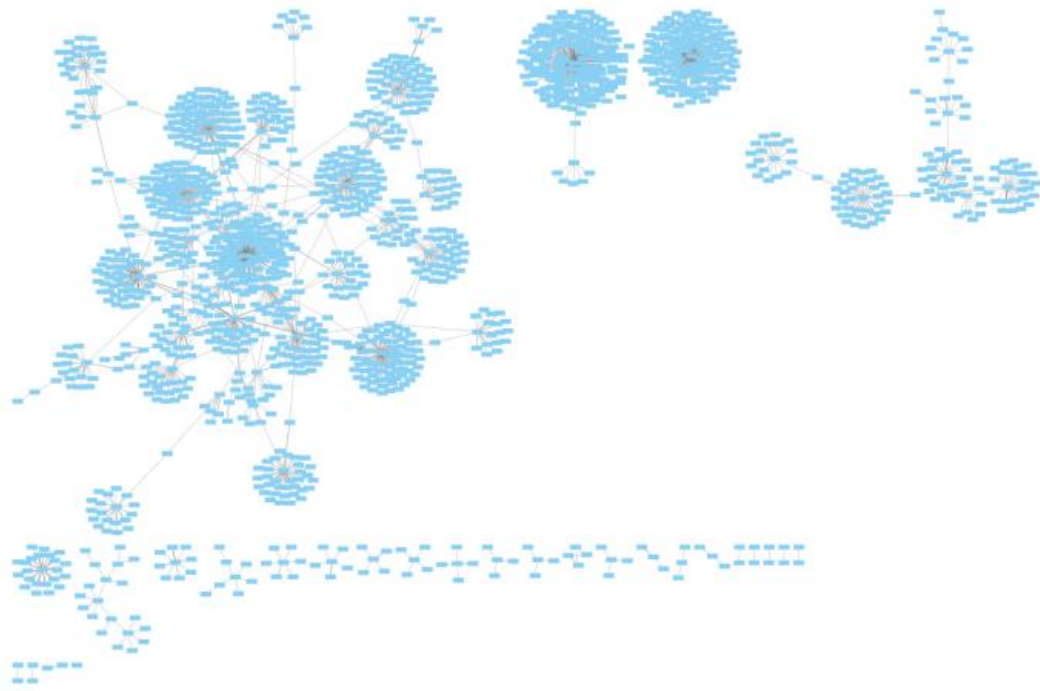


Fig 1 : Cytoscape network of upregulated Genes

- ClueGO analysis revealed key biological processes and pathways overrepresented among dysregulated genes in lung cancer, By visualizing gene networks and integrating these findings with differential expression analysis, we gained insights into how these genes work together and contribute to lung cancer progression.

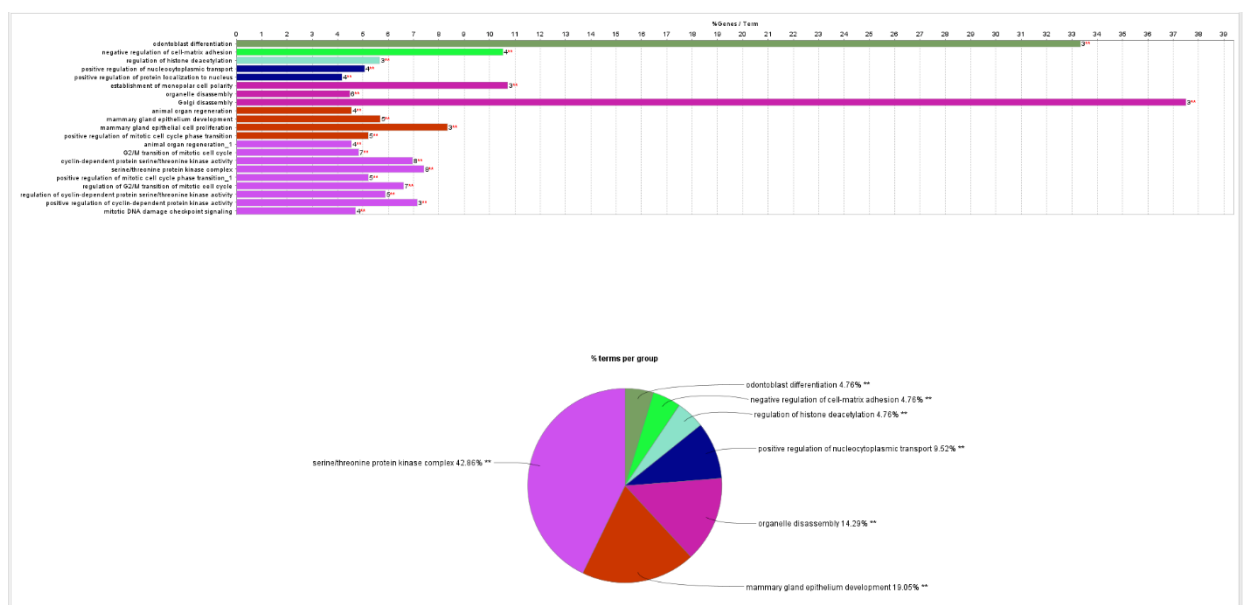


Fig:2 :results of Clue GO

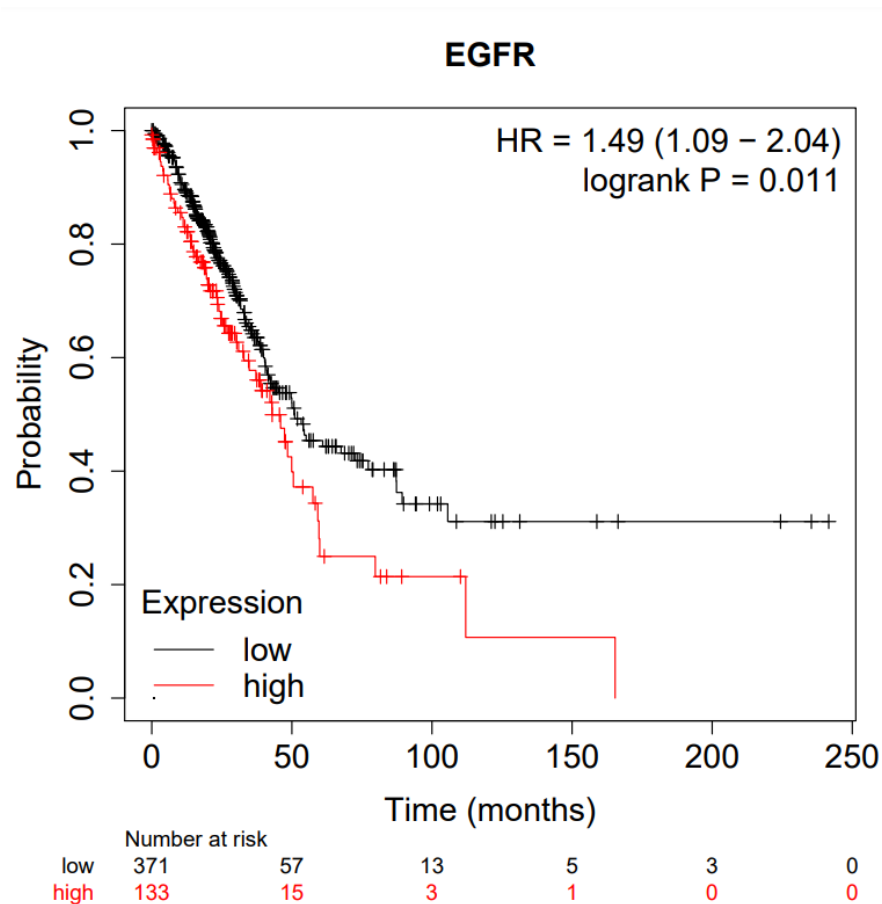
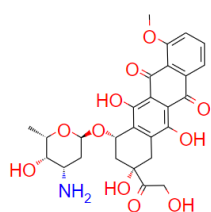


Fig 3 : Survival Plot

- The Biomarker selected is MS4A8 mRNA(mRNA)
- Drug name : Doxorubicin

Drug ID: DA2PC3



Drug Name	Doxorubicin	Drug Info
Drug Type	Small molecule	
Drug Status	Approved	
Representative Biomarker	MS4A8 mRNA (mRNA)	Biomarker Info
Representative Disease	Lung cancer [ICD-11: 2C25]	Disease Info

Fig: 4 Drug Details

- The predicted targets are A:LYS428:NZ , A:LYS328:NZ, A:ASP463:OD1
- **A:LYS428:NZ** : Aid in developing strategies to overcome this resistance and improve the effectiveness of doxorubicin treatment.

- **A:LYS328:NZ** : It is associated with doxorubicin resistance mechanisms in cancer cells. It plays a role in transporting doxorubicin out of cancer cells, which can reduce the effectiveness of the drug in treating cancer.
- **A:ASP463:ODI** : It's associated with the breakdown of proteins within lysosomes, which can affect the metabolism and efficacy of doxorubicin in cancer cells.
- The Interactions between the Targets and the drug has been interpreted

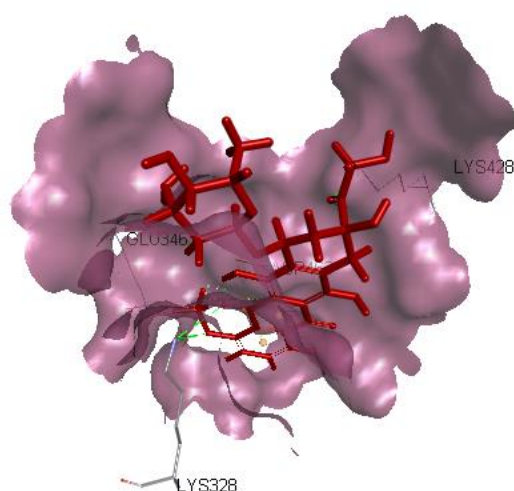


Fig 5 : 3D Structure

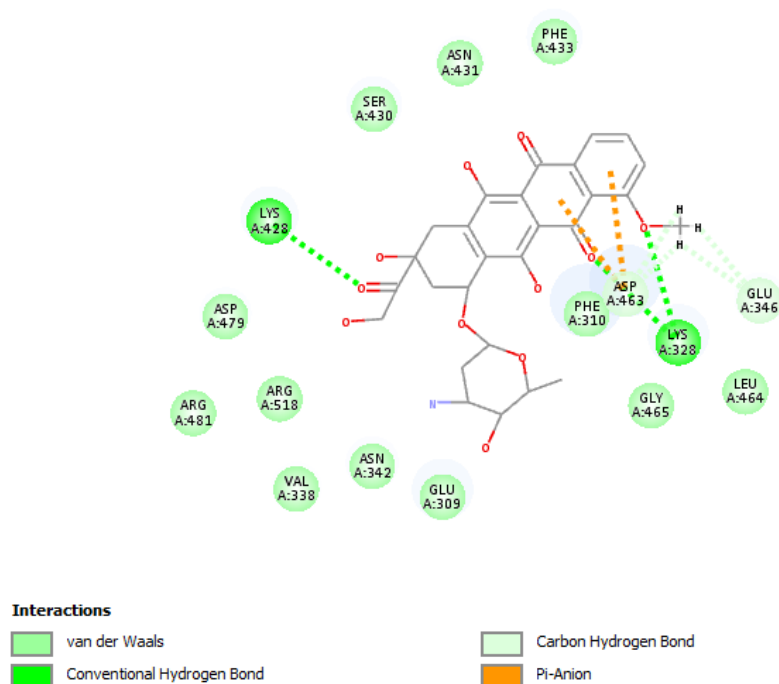


Fig 6: 2D Structure of the targets and the drug interaction

REVIEW ARTICLE

Synthesis and Critique: A Review of Systems Biology Literature

Introduction

To understand these multi-scale biological networks and establish a connection between genotype and phenotype, systems biology persists. A cell's phenotypic state is determined and controlled by the structure and dynamic characteristics of these networks. An organ-level response is produced by the coordinated action of multiple cells and tissues, and this reaction further controls the final physiological state. A hierarchical regulatory structure embedded in the entire network can result in an unfavourable physiological condition known as illness when it is abnormally disrupted. As a result, we examine how engineering approaches are applied to human disorders from a systems biology standpoint. Potential networks and modelling techniques for the analysis of human diseases are highlighted in the review.

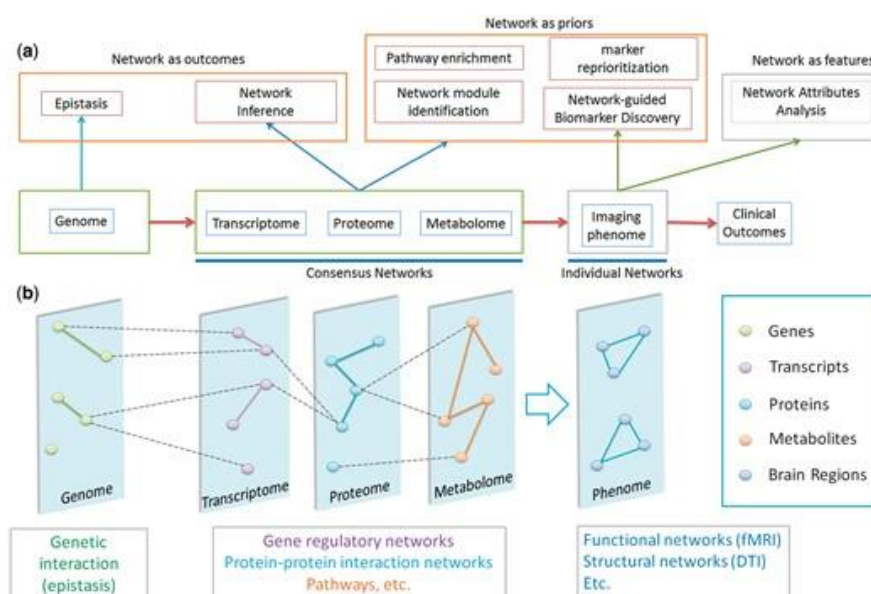
Network Inference and Reconstruction Techniques in Systems Biology

Signalling and regulatory pathways are employed by cells to link various components such as proteins, RNA, DNA, and tiny molecules. These pathways let cells adapt to changing surroundings by enabling them to coordinate various tasks. It is feasible to identify thousands of protein – protein or protein–DNA interactions as well as assess the expression levels of thousands of genes using high-throughput experimental techniques. The importance of theoretical techniques like statistical inference, graph analysis, and dynamic modelling in understanding this abundance of data is becoming increasingly apparent. This viewpoint examines biological predictions that come from three areas of systems biology: dynamic network modelling (linking the interaction network to biological entities), graph inference (rebuilding the network of interactions among a set of biological entities), and graph analysis (mining the information content of the network).

Systems Biology Methods to Comprehend Complex Illnesses

The seamless transfer of high-throughput omics technologies has been very beneficial to big data and systems biology. Network analysis has been extensively studied at all

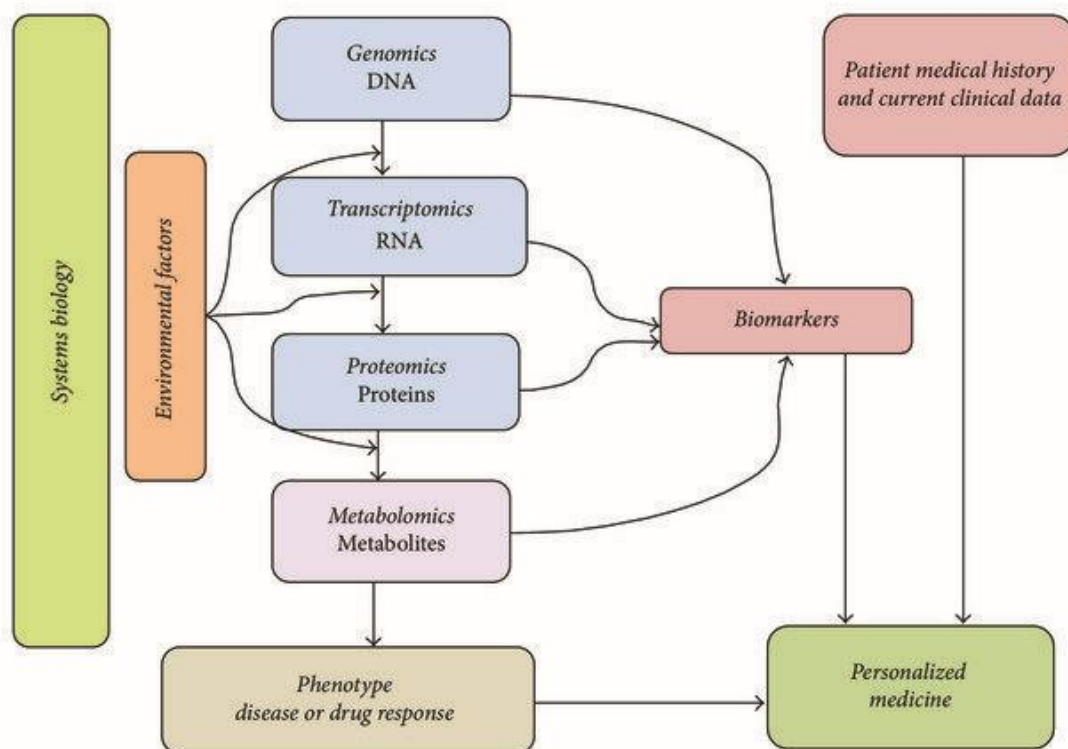
levels of biology because networks are important to biological processes. Compared to conventional single-layer biological analysis, integrative multi-omics analysis is a more advanced complex, and multidimensional field. It works especially well for treating polygenic and multifactorial complex disorders like cancer and Alzheimer's disease. Collaboration amongst a variety of professionals is necessary for successful multi-omics research, including biologists, computer scientists, bioinformaticians, and specialists in diseases. Although existing network approaches are promising, new and innovative approaches are expected to improve our comprehension of the complicated biological mechanisms underlying complex human diseases.



Role of Systems Biology in Personalized Medicine and Healthcare

Systems Biology's Place in Personalized Healthcare and Medicine Precision medicine, in which patients receive individualized therapies based on their unique traits, is replacing traditional disease diagnostic and treatment methods. Systems biology is playing a critical part in this shift. Systems biology plays a key role in personalized medicine, helping to estimate illness risk, provide tailored health monitoring, and provide preventative care in addition to helping to understand disease causes.

Systems biology provides powerful methods to monitor molecular profiles and identify minor changes suggestive of network disturbances, which is crucial for the early detection of disease consequences. For the diagnosis of molecular diseases, doctors and pathologists are incorporating systems techniques more and more.



Personalized insights into an individual's health and disease experiences at the molecular, cellular, and organ levels are now possible in biology and medicine because to systems techniques. By adjusting a patient's treatment to their unique biology and focusing on the causes of an illness rather than its symptoms, this tailored knowledge can greatly increase the cost-effectiveness of medical care. Furthermore, it enables customers to monitor the consequences of their lifestyle decisions and take proactive measures to enhance their health.

Future Prospects and Challenges in the Field of Systems Biology

Systems biology's future depends on using molecular biology technologies to test theories in both wild populations and laboratory settings. This history points to a change in the biological sciences' organizational structure toward a physics-like approach, in which theorists and experimentalists work closely together to solve problems. Its goal places a strong emphasis on resolving issues using methods and mindset. Research objectives, the creation of reliable computational tools, training

future scientists, and public outreach are its main points of emphasis. Two overarching research objectives have surfaced: comprehending natural system designs and building big, intricate computer models to address health-related issues. Promote automated data pipelines and dynamic statistical techniques from a methodological standpoint. Education programs should promote a synthesis of knowledge by combining formal education with public participation.

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Réka Albert. "Network Inference, Analysis, and Modeling in Systems Biology", The Plant Cell, 2007

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MATLAB COURSES

MATLAB ONRAMP

DESCRIPTION:

The MATLAB Onramp course is an interactive and self-paced online tutorial designed to introduce newcomers to MATLAB, a powerful programming language and environment used extensively in engineering, mathematics, science, and beyond. The course covers essential topics such as navigating the MATLAB environment, understanding basic syntax and programming concepts, working with variables, arrays, and matrices, creating plots and visualizations, and conducting basic data analysis.

WHAT I LEARNT?

- By the end of the course, learners should have a solid understanding of the MATLAB environment, syntax, and basic programming concepts. They will be able to navigate MATLAB confidently and write simple scripts to perform tasks like data analysis, visualization, and basic mathematical computations.
- MATLAB Onramp covers basic data analysis techniques, including manipulation of arrays and matrices, statistical calculations, and visualization of data.
- Completing the MATLAB Onramp serves as a solid foundation for diving into more advanced MATLAB topics and applications. Learners are equipped with the necessary knowledge and skills to explore more complex concepts, such as machine learning, signal processing, and advanced numerical methods.

COURSE DURATION

- 2 HOURS

COURSE GRADE

- 100%

MATLAB FUNDAMENTALS

DESCRIPTION

A MATLAB Fundamentals course typically covers the essential aspects of using MATLAB for numerical computation, data analysis, and visualization. A MATLAB Fundamentals course is designed to provide participants with a comprehensive understanding of MATLAB's core concepts and functionalities. Through a structured curriculum, participants are introduced to the MATLAB environment, including its command-line interface and graphical tools, enabling them to navigate the software effectively. Advanced topics, such as specialized toolboxes and symbolic computation, may be introduced depending on the course's depth.

WHAT I LEARNT?

- Develop proficiency in data analysis and visualization, learning how to import, manipulate, analyze, and present data effectively using MATLAB's powerful tools and functions.
- Modularization and function creation, enabling them to write maintainable and optimized code.
- Depending on the course's depth, participants may also gain exposure to advanced topics such as specialized toolboxes and symbolic computation, expanding their knowledge and skill set.

COURSE DURATION

- 16.5 HOURS

COURSE GRADE

- 100%

MACHINE LEARNING ONRAMP

DESCRIPTION

The Machine Learning Onramp course is a comprehensive introductory program designed to familiarize participants with the fundamental concepts and techniques of machine learning. The course begins with an overview of what machine learning is, its applications, and its importance in various industries. An introduction to neural networks and deep learning is provided, covering topics such as feedforward neural networks, convolutional neural networks (CNNs), and recurrent neural networks (RNNs).

WHAT I LEARNT?

- Participants will gain a solid understanding of the fundamental concepts, techniques, and algorithms used in machine learning. This includes supervised and unsupervised learning methods, data preprocessing techniques, model evaluation, and more.
- With a comprehensive understanding of core concepts such as supervised and unsupervised learning, coupled with proficiency in data preprocessing techniques and model evaluation, individuals gain the confidence to tackle real-world data challenges.

COURSE DURATION

- 2 HOURS

COURSE GRADE

- 100%

APP BUILDING ONRAMP

DESCRIPTION

An App Building Onramp course is designed to provide individuals with the foundational knowledge and skills needed to develop mobile applications. Understanding how to create user-friendly interfaces is crucial in app development. Many apps require interaction with a server or database for data storage and retrieval. The course may cover basics of backend development, including APIs, databases, and server-side scripting. Participants are introduced to best practices in app development, including optimizing app performance, security considerations, and adhering to platform-specific guidelines.

WHAT I LEARNT?

- Many App Building Onramp courses emphasize collaboration and version control using tools like Git. We will learn how to work effectively in a team environment and manage code changes using version control systems.
- The course serves as a stepping stone for individuals who wish to pursue further learning and specialization in specific areas of app development, such as iOS or Android development, game development, or mobile app security.

COURSE DURATION

- 1 HOUR

COURSE GRADE

- 100%

OBJECT - ORIENTED PROGRAMMING

DESCRIPTION

Through a combination of theoretical concepts and hands-on practical exercises, we delve into the principles and practices of OOP, learning to design, implement, and maintain robust and scalable software systems. The course typically covers key OOP concepts such as encapsulation, inheritance, and polymorphism, empowering students to organize code efficiently, enhance reusability, and facilitate easier maintenance. Moreover, students often explore advanced topics like design patterns, abstraction, and object relationships, gaining the skills necessary to develop complex applications and navigate real-world software development challenges

WHAT I LEARNT?

- The Object-Oriented Programming (OOP) course equips with a robust skill set and a deep understanding of software development principles.
- Upon completion, students emerge with the ability to design, implement, and maintain complex software systems using OOP concepts such as encapsulation, inheritance, and polymorphism. They gain proficiency in organizing code efficiently, enhancing reusability, and ensuring scalability.
- Developing problem-solving skills and learn to navigate real-world software development challenges by applying design patterns and leveraging abstraction

COURSE DURATION

- 2 HOURS

COURSE GRADE

- 100%

COMPUTER VISION ONRAMP

DESCRIPTION

The Computer Vision Onramp course is an introductory program designed to provide learners with a comprehensive understanding of computer vision concepts and techniques. The course usually starts with an overview of what computer vision is, its applications, and its significance in various fields such as healthcare, autonomous vehicles, robotics, etc. Learners are introduced to fundamental concepts such as image representation, color spaces, image filtering, and feature extraction.

WHAT I LEARNT?

Upon completing the Computer Vision Onramp course, participants emerge with a robust understanding of the fundamental principles and techniques underlying computer vision.

Armed with this knowledge, we gain the ability to process and analyze images effectively, extracting meaningful information and insights.

To become proficient in employing various image processing techniques, feature extraction methods, and object detection algorithms to tackle real-world challenges.

COURSE DURATION

- 2 HOURS

COURSE GRADE

- 100%

REINFORCEMENT LEARNING ONRAMP

DESCRIPTION

The Reinforcement Learning Onramp is a structured learning pathway designed to introduce individuals to the fundamentals of reinforcement learning (RL). It serves as a starting point for beginners who want to understand the principles, algorithms, and applications of RL in various fields such as artificial intelligence, robotics, game playing, and more. MDPs form the mathematical framework for modeling RL problems. The course covers MDPs, including states, actions, transition probabilities, and rewards. Deep RL integrates neural networks with RL algorithms to handle high-dimensional state spaces. The course introduces deep Q-networks (DQN), policy gradients, and actor-critic methods.

WHAT I LEARNT?

- Acquiring a comprehensive understanding of the fundamental concepts, principles, and terminology of reinforcement learning, including Markov Decision Processes (MDPs), value functions, policies, and exploration-exploitation trade-offs.
- Help us to develop problem-solving skills necessary to tackle real-world reinforcement learning problems across diverse domains such as robotics, gaming, finance, healthcare, and more. learnt how to formulate RL problems, choose appropriate algorithms, and evaluate their performance.
- The course will enhance learners' critical thinking abilities as they analyze and evaluate the performance of different RL algorithms in various scenarios.

COURSE DURATION

- 2.5 HOURS

COURSE GRADE

- 100%

MACHINE LEARNING WITH MATLAB

DESCRIPTION

The "Machine Learning with MATLAB" course is an immersive educational experience designed to equip participants with the knowledge and skills necessary to excel in the dynamic field of machine learning. Through a combination of theoretical foundations and hands-on practical exercises, this course delves into various aspects of machine learning, from fundamental concepts to advanced techniques. This course covers the topics such as data preprocessing, feature selection, model evaluation, and algorithm implementation using MATLAB, a powerful computational tool widely used in the field of data science and machine learning

WHAT I LEARNT?

- Help us to Gain proficiency in utilizing MATLAB, a versatile computational tool, to develop, train, and deploy machine learning models for various real-world applications.
- With hands-on experience in data preprocessing, feature selection, model evaluation, and algorithm implementation, participants are equipped to tackle complex problems and make informed decisions in data-driven environments.
- Furthermore, acquiring the ability to interpret and communicate the results of machine learning models effectively, empowering them to contribute meaningfully to projects and initiatives across diverse industries.

COURSE DURATION

- 12 HOURS

COURSE GRADE

- 100%

MATLAB FOR DATA PROCESSING AND VISUALIZATION

DESCRIPTION

The "MATLAB for Data Processing and Visualization" course is designed to provide participants with a comprehensive understanding of how to utilize MATLAB, a powerful programming language and computing environment, for handling, analyzing, and visualizing data. The course begins with an overview of MATLAB's interface, basic syntax, and fundamental operations. Participants learn how to navigate the MATLAB environment, work with variables, and execute basic commands. The course covers a range of data analysis techniques available in MATLAB, including descriptive statistics, hypothesis testing, regression analysis, and clustering. Participants learn how to apply these techniques to extract meaningful insights from their data.

WHAT I LEARNT?

- This help us to learn how to create insightful visualizations of their data using MATLAB's plotting functions, including 2D and 3D plots, histograms, scatter plots, and more. They will also learn how to customize the appearance of their plots to effectively communicate their findings.
- Many courses include hands-on projects or assignments where participants apply their MATLAB skills to analyze real-world datasets and create meaningful visualizations.
- How to perform basic and advanced data analysis tasks using MATLAB, such as statistical analysis, curve fitting, signal processing, image processing, and machine learning.

COURSE DURATION

8 HOURS

COURSE GRADE

100%

DEEP LEARNING WITH MATLAB

DESCRIPTION

Deep learning is a branch of machine learning that teaches computers to do what comes naturally to humans: learn from experience. Deep learning uses neural networks to learn useful representations of features directly from data. The Deep Learning with MATLAB course provides a comprehensive introduction to deep learning concepts and techniques using MATLAB. With "Deep Learning with MATLAB," users can leverage a vast array of built-in algorithms and tools, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), and generative adversarial networks (GANs). The intuitive graphical interface simplifies the process of model creation, allowing users to focus on experimentation and innovation rather than grappling with complex coding.

WHAT I LEARNT

- By harnessing deep learning algorithms within MATLAB's framework, researchers and practitioners have achieved remarkable outcomes. One notable area of impact is in image recognition and classification, where convolutional neural network (CNNs) have demonstrated unprecedented accuracy in identifying objects within complex visual scenes
- deep learning with MATLAB has revolutionized medical image analysis, facilitating the detection of anomalies in MRI scans, X-rays, and histopathology slides. Researchers can leverage MATLAB's deep learning tools to create customized architectures tailored to specific medical imaging tasks, ultimately enhancing diagnostic accuracy and patient care.

COURSE DURATION:

- 7 hours

COURSE GRADE

- 100%

DEEP LEARNING ONRAMP

DESCRIPTION

The Deep Learning Onramp course is designed to provide participants with a comprehensive introduction to deep learning, a subset of machine learning focused on neural networks and their applications. The course starts with an overview of what deep learning is, its applications, and its significance in modern AI. The course teaches how to build and train neural networks using popular frameworks like TensorFlow or PyTorch. Participants learn about different types of neural networks, including feedforward, convolutional, and recurrent networks. Deep learning models require large amounts of data for training. Therefore, the course covers techniques for data preparation, cleaning, and preprocessing to ensure that the data is suitable for training.

WHAT I LEARNT?

- Many deep learning courses involve hands-on projects where students apply what they've learned to solve real-world problems. Completing these projects helps reinforce concepts and build a portfolio of work to showcase to potential employers.
- Completing a Deep Learning Onramp course can serve as a solid foundation for further study or employment in the field of deep learning and artificial intelligence. It can provide a starting point for more advanced courses or projects, or even entry-level positions in industries where deep learning expertise is valued.

COURSE DURATION:

- 2 hours

COURSE GRADE

- 100%

MATLAB PROGRAMMING TECHNIQUES

DESCRIPTION

The MATLAB Programming Techniques course is designed to provide participants with a comprehensive understanding of MATLAB programming concepts and techniques. Throughout the course, students will learn how to efficiently utilize MATLAB for various computational tasks, data analysis, and visualization. Matlab fundamental section covers fundamental concepts such as variables, arrays, data types, operators, and basic MATLAB syntax. Using MATLAB's powerful plotting functions to create various types of plots including 2D and 3D plots, histograms, and scatter plots for data visualization. Techniques for integrating MATLAB with other programming languages (e.g., C/C++, Python) and tools for collaborative development.

WHAT I LEARNT?

- Gaining a solid understanding of the MATLAB programming language, its syntax, and its various features.
- This course help us to develop algorithms and implement them in MATLAB for various applications, such as signal processing, image processing, control systems, and more.
- Understanding the importance of documenting their code and results effectively, including writing clear comments and generating reports or presentations.

COURSE DURATION:

- 16 hours

COURSE GRADE

- 100%

IMAGE PROCESSING ONRAMP

DESCRIPTION

The Image Processing Onramp course is a comprehensive introduction to the fundamentals of image processing. Designed for beginners and those seeking to enhance their understanding of digital image manipulation, this course covers a wide range of topics including image acquisition, preprocessing techniques, filtering, segmentation, feature extraction, and image enhancement. Participants will gain hands-on experience through practical exercises using industry-standard software tools and programming languages commonly employed in image processing applications. professional in fields such as computer vision, medical imaging, or remote sensing, this course provides a solid starting point for further exploration and application of image processing techniques.

WHAT I LEARNT?

- Completing the Image Processing Onramp course can have numerous outcomes, depending on your goals and aspirations. To gain a solid understanding of the fundamental concepts and techniques used in image processing, equipping you with valuable knowledge applicable across various industries, from healthcare to robotics.
- This course can serve as a stepping stone for further exploration and specialization in fields like computer vision, machine learning, and artificial intelligence.
- Additionally, mastering image processing techniques can enhance your problem-solving skills, allowing you to tackle real-world challenges more effectively.

COURSE DURATION:

- 2 hours

COURSE GRADE

- 100%

SIGNAL PROCESSING ONRAMP

DESCRIPTION

Completing the Signal Processing Onramp course is an essential step towards mastering signal processing techniques using MATLAB. Throughout the course, participants delve into fundamental concepts such as time-domain and frequency-domain analysis, filtering, convolution, and spectral analysis. They gain a comprehensive understanding of how signals are processed and analyzed across various domains, including audio, speech, image, and biomedical signal processing. Participants also acquire practical skills in MATLAB, learning how to implement signal processing algorithms and techniques using MATLAB's built-in functions and tools. They explore methods for filtering signals, performing Fourier analysis, and conducting digital signal processing (DSP), enabling them to manipulate and analyze signals effectively.

What I Learnt ?

- Participants gain a strong foundational understanding of signal processing concepts and techniques, including time-domain and frequency-domain analysis, filtering, convolution, and spectral analysis.
- Implementing signal processing algorithms and techniques using MATLAB's tools and functions. They learn how to manipulate and analyze signals effectively, perform filtering operations, and conduct spectral analysis.

COURSE DURATION:

- 1.5 hours

COURSE GRADE

- 100%

Solving Nonlinear Equations with MATLAB

DESCRIPTION

Completing the "Solving Nonlinear Equations with MATLAB" course equips participants with a comprehensive understanding of methods and techniques for solving nonlinear equations using MATLAB. Throughout the course, participants delve into various numerical methods, optimization techniques, and root-finding algorithms commonly employed in solving nonlinear equations. Participants gain proficiency in implementing these methods and algorithms using MATLAB's built-in functions and tools.

What I Learnt ?

- Participants become proficient in using a variety of numerical methods and algorithms for solving nonlinear equations, such as iterative methods, optimization techniques, and root-finding algorithms.
- advanced MATLAB programming skills, learning how to implement and apply numerical methods to solve nonlinear equations efficiently.
- participants acquire practical experience in solving a diverse range of nonlinear equation problems encountered in various fields, such as engineering, science, finance, and economics.

COURSE DURATION:

- 3 hours

COURSE GRADE

- 100%

Statistics Onramp

DESCRIPTION

The "Statistics Onramp" course offers participants a comprehensive introduction to statistics concepts and their practical applications using MATLAB. Throughout the course, participants delve into fundamental statistical principles, methods, and techniques, gaining a solid foundation in statistical analysis and interpretation. Key topics covered in the course include descriptive statistics, probability distributions, hypothesis testing, confidence intervals, regression analysis, and ANOVA (analysis of variance). Participants learn how to use MATLAB's statistical functions and tools to perform various statistical analyses and visualize data effectively.

What I Learnt ?

- Participants gain a strong foundational understanding of statistical concepts, including descriptive statistics, probability distributions, hypothesis testing, and regression analysis.
- Practical skills in using MATLAB for statistical analysis, learning how to perform various statistical tests, calculations, and visualizations efficiently.
- Interpreting data using statistical methods, enabling them to draw meaningful conclusions and make informed decisions based on data insights.

Course Duration:

- 1.5 hours

COURSE GRADE

- 100%

MATLAB CERTIFICATES



Course Completion Certificate

Yasmin Tabasum

has successfully completed **100%** of the self-paced training course

MATLAB Programming Techniques



DIRECTOR, TRAINING SERVICES

1 April 2024



Course Completion Certificate

Yasmin Tabasum

has successfully completed **100%** of the self-paced training course

Computer Vision Onramp



DIRECTOR, TRAINING SERVICES

15 December 2023



Course Completion Certificate

Yasmin Tabasum

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Deep Learning Onramp


DIRECTOR, TRAINING SERVICES

22 November 2023



Course Completion Certificate

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Deep Learning with MATLAB


DIRECTOR, TRAINING SERVICES

9 December 2023



Course Completion Certificate

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Image Processing Onramp



Craig L. Santos

DIRECTOR, TRAINING SERVICES

24 March 2024



Course Completion Certificate

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Machine Learning Onramp



Craig L. Santos

DIRECTOR, TRAINING SERVICES

13 November 2023



Course Completion Certificate

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MATLAB for Data Processing and Visualization



DIRECTOR, TRAINING SERVICES

14 December 2023



Course Completion Certificate

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MATLAB Fundamentals



DIRECTOR, TRAINING SERVICES

20 November 2023



Course Completion Certificate

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has successfully completed **100%** of the self-paced training course

MATLAB Onramp



Craig Santos

DIRECTOR, TRAINING SERVICES

10 November 2023



Course Completion Certificate

Yasmin Tabasum

has successfully completed **100%** of the self-paced training course

Object-Oriented Programming Onramp



Craig Santos

DIRECTOR, TRAINING SERVICES

1 December 2023



Course Completion Certificate

Yasmin Tabasum

has successfully completed **100%** of the self-paced training course

Reinforcement Learning Onramp



DIRECTOR, TRAINING SERVICES

14 December 2023



Course Completion Certificate

Yasmin Tabasum

has successfully completed **100%** of the self-paced training course

Signal Processing with MATLAB



DIRECTOR, TRAINING SERVICES

30 March 2024



Course Completion Certificate

Yasmin Tabasum

has successfully completed **100%** of the self-paced training course

Simulink Onramp



DIRECTOR, TRAINING SERVICES

27 March 2024



Course Completion Certificate

Yasmin Tabasum

has successfully completed **100%** of the self-paced training course

Solving Nonlinear Equations with MATLAB



DIRECTOR, TRAINING SERVICES

24 March 2024



Course Completion Certificate

Yasmin Tabasum

has successfully completed **100%** of the self-paced training course

Statistics Onramp



DIRECTOR, TRAINING SERVICES

15 November 2023

