ISAAC TOLULOPE OLATUNJI

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DEGREE(S)

- Rochester Institute of Technology, Rochester, USA, 2021 – 2023
  - **Master of Science in Bioinformatics**
- College of Medicine of the University of Lagos (CMUL), Lagos, Nigeria, 2009-2016.
  - **Bachelor of Dental Surgery (BDS)**

ONLINE COURSES COMPLETION CERTIFICATE(S)

- Harvard University, 2023.
  - Introduction to Computer Science (CS50)
- Wellcome Connecting Science, 2021.
  - Bioinformatics for Biologists: An Introduction to Linux, Bash Scripting and R
- University of California San Diego, 2021.
  - Drug Discovery
- Johns Hopkins University, 2020.
  - Introduction to Genomic Technologies
- Icahn School of Medicine at Mount Sinai, 2020.
  - Introduction to Systems Biology.
- MathWorks, 2020.
  - MATLAB Onramp
- IBM, 2020.
  - Machine Learning with Python

- IBM, 2020.
  - Data Visualization with Python
- IBM, 2020.
  - Data Analysis with Python
- IBM, 2020.
  - Databases and SQL for Data Science
- IBM, 2020.
  - Python for Data Science and AI
- IBM, 2020.
  - Data Science Methodology
- IBM, 2020.
  - Tools for Data Science
- IBM, 2020.
  - What is Data Science?
- University of Manchester, 2018.
  - Clinical Bioinformatics: Unlocking Genomics in Healthcare
- Wellcome Genome Campus Advanced Courses and Scientific Conferences, 2018.
  - Bacterial Genomes: From DNA to Protein Function Using Bioinformatics
- World Health Organization, 2018.
  - Implementation Research
- University of Glasgow, January, 2018.
  - Cancer in the 21 ST Century: The Genomic Revolution

PUBLICATION(S) AND PROJECT(S)

- [Journal Publication] Olatunji I and Cui F (2023) **Multimodal AI for prediction of distant metastasis in carcinoma patients**. *Front. Bioinform.* 3:1131021. doi: 10.3389/fbinf.2023.1131021
- [Journal Publication] Olatunji I, Bardaji DKR, Miranda RR, Savka MA and Hudson AO (2024) **Artificial intelligence tools for the identification of antibiotic resistance genes**. *Front. Microbiol.* 15:1437602. doi: 10.3389/fmicb.2024.1437602

- [News Article Publication] Andre Hudson and Isaac Olatunji. **Urgent innovation needed in antibiotic development**. Rochester Democrat and Chronicle
- [Poster Presentation] Isaac Olatunji, Feng Cui. **Machine Learning Predicts Genes Associated with Cancer Metastasis**. Poster Presentation. AI@RIT Summit.
- [Journal Publication] Isaac Olatunji. **Potential application of tumor suppressor microRNAs for targeted therapy in head and neck cancer**: A mini-review. Oral Oncology, Volume 87, 2018, Pages 165-169, ISSN 1368-8375.
- [Event Presentation] Olatunji I and Cui F (2023) **Multimodal AI for prediction of distant metastasis in carcinoma patients**. *Google CSRMP Alumni Presenter.*
- [Project] **Prediction of Distant Metastasis from Histopathology Images With Gene Expression as Intermediate.**
- [Project] **Breast Cancer Segmentation on Histopathology Images.** A Convolutional Neural Network based project where U-net architecture was coded from scratch using tensorflow, and other python libraries. Model was trained for identification of nuclei in histopathology images.
- [Project] **Differential gene expression analysis in sulphoraphane treated versus vehicle treated obese rats**. Aim was to investigate if any of the Differentially Expressed Genes (DEGs) are related to the leptin receptor or Nuclear Factor Erythroid 2 Related Factor (NRF2) pathways. Data acquisition from SRA, Quality Control, Alignment, Count Matrices, Differential Gene Expression Analysis, Visualization, DEGs interpretation.
- [Project] **Assessment of ligand protein binding in statins-HMG Co-A reductase complex.** Molecular docking of various statin class ligands (ex. simvastatin, pravastatin, etc) to the HMG Co-A reductase protein using AutoDock Vina in the PyRx software in order to assess their binding affinities. Visualization and analysis of the various statin-HMG Co-A complex interactions based on features like hydrophobicity, and B factor in the UCSF Chimera software.
- [Project] **Machine Learning Predicts Cancer Recurrence and Metastasis in Head and Neck Cancer.** A project in R that assessed ability of three types of machine learning algorithm (Naïve Bayes, SVM- with linear, polynomial, radial basis kernel functions, and Random Forest) to accurately predict cancer recurrence and metastasis from patients' clinical data downloaded from TCGA.
- [Project] **Molecular Modelling and Proteomics Course Individual Projects**

- Python implementation of Chou Fasman algorithm for protein secondary structure prediction.
- Sequence specific retention calculator for calculation of retention time in reverse phase chromatography.
- Python scripts within Chimera software for download and manipulation of PDB data.

- [Project] **Diagnose Your Toothache.** A novel algorithm to diagnose pain of dental origin from information about a patient's symptoms, and medical history. (Python, MySQL)

JOURNAL REVIEW ACTIVITIES (Verifiable on webofscience.com)

- Reviewer, Journal of Surgery and Operative Care (online journal).
- Reviewer, Journal of Cervical Cancer Research (online journal).
- Reviewer, Journal of Medical Oncology (online journal).
- Reviewer, Journal of Clinical Oncology and Cancer Research (online journal).
- Reviewer, Journal of Otolaryngology, Head and Neck Cancer (online journal).
- Reviewer, Springer book proposal (Medicine, Life Sciences and Biomedicine).
- Reviewer, Journal of Receptors and Signal Transduction (online journal).
- Reviewer, Acta Biochimica Polonica (online journal).
- Reviewer, PLOS ONE (online journal).

SKILLS

- **Programming Languages**: Python, R, C / C++, SQL, Linux.
- **Libraries and Tools**: Pandas, NumPy, Matplotlib, Sklearn, OpenCV, Keras, TensorFlow, Pytorch, OpenSlide, Tiatolbox, PathML, HISAT2, DESEQ2, Modeller, PyRx, Chimera, SLURM, AWS.
- **Databases**: MySQL, Google BigQuery.
- **Concepts**: Machine Learning, Deep Learning, Convolution Neural Network, Transformer, Graph Neural Network, Molecular Biology, Genomics, Proteomics, Computational Pathology, Algorithms, Statistics, Dentistry, Medicine.

WORK EXPERIENCE

- **Research Assistant, Andre Hudson Lab, Feb 2024 – Aug, 2024:**
  - AI and antibiotic resistance.
  - Research.
- **Research Assistant, Feng Cui Lab, Jun 2023 – Dec 2023:**
  - Application of AI techniques (LLM and GNN) for analysis of biomedical data.
  - Literature review.
  - Research.
- **Graduate Teaching Assistant, General Biology Laboratory, Jan 2022 – Dec 2022:**
  - Delivered lab instructions to two classes of twenty-eight students.
  - Graded student's submissions.
  - Held office hours.
- **Dental Team Lead, EHA Clinics, 2019-2021**:
  - Diagnosis and treatment of patients with oral and maxillofacial diseases.
  - Administrative duties and communication between the dental department and upper management.
  - Actively involved in writing of standard operating procedures.
  - Worked with the Informatics team to create a digitized dental patient evaluation form.

AWARDS / RECOGNITIONS

- Google CS Research Mentorship Program (CSRMP) Alumni Research Presenter, 2023.

  Presented a publication to the current CSRMP cohort as an Alumnus.
- Google CS Research Mentorship Program (CSRMP), 2023.

  Mentorship from Google Researchers towards a computer science research career
- Google PhD Fellowship Summit Invited CSRMP Alumni, 2023.
- John Wiley Jones Scholarship for International Students, 2022.
- Bioinformatics Department Merit Scholarship, 2021.
- EHA Clinics Employee of the month, May, 2020.

LEADERSHIP SERVICES

- Dental Team Lead, EHA Clinics, 2021.
- Member, Constitution Review Committee, Medical Community Development Service group, Bauchi state, 2018.
- Medical Advisory Chairman, National Youth Service Corps orientation camp clinic, Bauchi state, 2017
- Pioneer member, University of Lagos Association of Dental Students (ULADS) Senate, 2014/2015
- Chairman, Ethics and Disciplinary Committee, University of Lagos Association of Dental Students (ULADS) Senate, 2014/2015

EXTRACURRICULAR ACTIVITIES

- Head Coach of undergraduate class football team for 3 years (2013-2015):
    - Won the ULADS cup with the team twice and came 1st runner-up once.
    - Decided tactics, lead training sessions, players selection and co-ordination, man management.
- Football management games and other video games
- Singing

PERSONAL STATEMENT

A question I have often been asked by persons who have had a glimpse of my career trajectory so far is: “Why the switch?”. A master degree in Bioinformatics really seems like a massive pivot from my first degree in Dental Surgery. But then, is it? My time in the clinical environment provided me the rare privilege of impacting people’s lives from a close proximity, and on a personal level. However, it also exposed me to the management deficiencies that are often encountered, whether it is in the use of available investigative technologies or in medications with unpalatable side effects or the complete lack of cure for certain illnesses. One example of many similar scenarios that summarizes this situation happened during my National Youth Service year when I attended to a 19 year-old patient who presented with a rapidly progressive facial swelling and other features that pointed towards a diagnosis of malignancy. From all relevant variables, his chances of survival were almost non-existent. The possibility of a world where diseases like cancer and other seemingly incurable diseases will be met by effective, and potent management technologies and therapies with the least discomfort to patients is the fuel that has stirred me so far. I am looking to maximize my experience in the clinic for doing impactful research with outcomes that can be translated back into the clinic to address the crucial gaps. Having the consciousness of my abilities and potentials, I reckon I could reach more people from outside of the clinic, through my research.

In the past years, I have evolved from acquiring basic research and computational skills in the field of molecular and computational biology to leading multiple works, some of which have now been published. In one original research which I lead from conception of idea, to research design, execution, and journal review process, we applied various machine learning and deep

learning techniques for identification of transcriptomics biomarkers of cancer metastasis, and investigated the use of multimodal data (genomic, imaging and clinical data) for prediction of distant metastasis. This work combined knowledge and skills from biological data analysis, medical image analysis, and awareness of relevant clinical variables around cancer metastasis. Our results confirmed that no single specific gene can certify the presence or absence of distant metastasis, rather, metastasis is influenced by various combinations of genes which are different in each cancer type. Also, genomic data provided the highest contribution for better prediction of metastasis amongst the three data types considered.

I am passionate about the already evident widespread impacts of Artificial Intelligence (AI) for creating viable solutions to biomedical challenges. A germane example is seen in the advancement of AI-discovered drug candidates through the clinical trial pipeline in companies like Insilico Inc., as well as the reported progress in other AI-based drug discovery biotech startups. The recent award of the Nobel prize in physics, and chemistry to AI and biology researchers sums it up. A relevant project in this line that I lead involved prediction of protein function by concatenating protein sequence encoded with Large Language Model (LLM) and protein structure represented as a graph that is processed through Graph Convolutional Neural Network (GCNN). Furthermore, I created other modules that captured new protein properties that were integrated with the encoded sequence and structure.

My acquired skills and experience over these years have prepared me well for this stage. Aside from planning and carrying out research, an important skill I have also acquired is the dissemination of research. I participated actively in writing up the published works I have been

involved in, including review papers on AI tools for prediction of Antibiotic Resistance Genes (ARGs), and application of tumor suppressor microRNAs as therapy in Head and Neck Cancer (HNC), fully going through the scientific journal publication review and feedback process. I possess strong writing and oral communication skills. Being selected as part of Google's Computer Science Research Mentorship Program (CSRMP) provided me the opportunity to engage with established, and upcoming researchers with similar interests.

Outside of formal learning settings, I also worked on personal projects. An example personal project I worked on is a desktop application that is based on a novel algorithm for predicting diagnosis of pain of dental origin from a patient's history data. The early version of the application can be accessed here: (https://drive.google.com/drive/folders/1HTvNJC7sZZ0FqG9ApPorSKZ7VQxd3Tns?usp=drive_link). I have since further optimized the algorithm, incorporated more features and created a flask application.

My expectation while going through the PhD in Computer Science program at Columbia University is to leverage and finetune my past multidisciplinary experiences towards creating innovations that would transform patients' lives positively. Having read through the list of faculties, I find the works of Drs. Mohammed AlQuraishi, Elham Azizi, and Noemie Elhadad exciting and relevant to my interest in precision medicine and drug discovery, and I am looking forward to working with any of these brilliant researchers. I am also interestingly curious about the work of Dr. Gamze Gursoy in the area of data privacy. I look forward to doing impactful works that merge the fields of AI and biomedicine, and I believe there is no better place to do

this at this time than at Columbia University's Computer Science program where inspiring works are already ongoing.

Thank you for your consideration!

Isaac Olatunji