

**A Predictive Model For Detecting Underage Voters using Deep Learning  
and Blockchain Technology**

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**A Predictive Model For Detecting Underage Voters using Deep Learning  
and Blockchain Technology**

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF  
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SCIENCE AND TECHNOLOGY, COVENANT UNIVERSITY, OTA.**

**OCTOBER, 2021**

## ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfilment of the requirements for the award of the degree of Master of Science in Computer Science in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Nigeria.

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## **DECLARATION**

I, **NWANKWO, CHUKWUMA MICHAEL (14CG01792)** declares that this research was carried out by me under the supervision of Prof. Victor. C. Osamor of the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Nigeria. I attest that the dissertation has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this dissertation are duly acknowledged.

**NWANKWO, CHUKWUMA MICHAEL**

**Signature and Date**

## **CERTIFICATION**

We certify that this dissertation titled “**AGE PREDICTION SOLUTION FOR E-VOTING ADMINISTRATION AGAINST UNDERAGE VOTERS**” is an original research work carried out by **NWANKWO, CHUKWUMA MICHAEL (14CG01792)** in the Department of Computer and Information Sciences, College of Science and Technology, Covenant University, Ota, Ogun State, Nigeria under the supervision of Prof. Victor C. Osamor. We have examined and found this work acceptable as part of the requirements for the award of Master of Science, Computer Science.

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## **DEDICATION**

To ever-merciful, ever-gracious, and faithful God, who has given the grace and privilege to be able to achieve this fit in my educational carrier.

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## LIST OF ABBREVIATIONS

<b>3D</b>	Three Dimension
<b>3MDNN</b>	Maximum Margin Multimodal
<b>AAM</b>	Active Appearance model
<b>AE</b>	Autoencoder
<b>AES</b>	Advanced Encryption Standard
<b>AI</b>	Artificial Intelligence
<b>ANN</b>	Artificial Neural Network
<b>ASR</b>	Automatic Speech Recognition
<b>BOVS</b>	Blockchain-based Online Voting System
<b>BCI</b>	Brain-Computer Interface
<b>CADD</b>	Combined Annotation-Dependent Depletion
<b>CAE</b>	Contractive Autoencoder
<b>CD</b>	Contrastive Divergence
<b>CRBM</b>	Conditional Restricted Boltzmann Machine
<b>CNN</b>	Convolutional Neural Network
<b>DAE</b>	Deep Autoencoder
<b>DBN</b>	Deep Belief Network
<b>CDBN</b>	Convolutional Deep Belief Network
<b>CRF</b>	Conditional Random Fields
<b>DCN</b>	Deep Convolutional Network
<b>DL</b>	Deep Learning
<b>DNN</b>	Deep Learning Network
<b>DPM</b>	Deformable Part-based Model
<b>DRBM</b>	Discriminative Restricted Boltzmann Machine
<b>DRE</b>	Recording Electronics Voting Machine
<b>DRL</b>	Deep Reinforcement Learning

<b>ELM</b>	Extreme Learning Machine
<b>EVM</b>	Ethereum Virtual Machine
<b>FC</b>	Functional Connectivity
<b>FNIRS</b>	Functional Near-Infrared Spectroscopy
<b>FTT</b>	Fast Fourier Transfer
<b>HDRBM</b>	Hybrid Discriminative Restricted Boltzmann Machine
<b>HMM</b>	Hidden Markov Model
<b>HPR</b>	Hand Posture Recognition
<b>HRRS</b>	High Resolution Remote Sensing
<b>HTML</b>	Hypertext Markup Language
<b>GMM</b>	Gaussian Mixture Model
<b>GRU</b>	Gated Recurrent Unit
<b>GUI</b>	Graphical User Interface
<b>IDL</b>	Institute of Deep Learning
<b>INEC</b>	Independent National Electoral Commission
<b>IODA</b>	Input/output Deep Architecture
<b>IPFS</b>	Interplanetary File System
<b>LM</b>	Language Model
<b>LSTM</b>	Long-Short Time Memory
<b>ML</b>	Machine Learning
<b>MLP</b>	Multi-layer Perception
<b>MMI</b>	Maximum Mutual Information
<b>MRI</b>	Magnetic Resonance Imaging
<b>MSE</b>	Mean Square Error
<b>NFT</b>	Non-Fungible Token
<b>NN</b>	Neural Network
<b>PBB</b>	Public Ballot Board



<b>POW</b>	Proof of Work
<b>PSOWNN</b>	Particle Swarm Optimized Wavelet Neural Network
<b>RBFNN</b>	Radial Bases Function Neural Network
<b>RBM</b>	Restricted Boltzmann Machine
<b>RCN</b>	Recursive Convolutional Network
<b>RL</b>	Reinforcement Learning
<b>RNN</b>	Recurrent Neural Network
<b>SD</b>	Standard Deviation
<b>SDAE</b>	Separable Deep Autoencoder
<b>SFC</b>	Supervised Fuzzy Clustering
<b>SVM</b>	Support Vector Machine
<b>TDNN</b>	Time-delay Neural Network
<b>TRBM</b>	Temperature Restricted Boltzmann Machine
<b>UML</b>	Unified Modelling Language

## ABSTRACT

Elections around the world have become a major international concern since the inception of modern democracy. It is a fact that the success of any democracy depends largely on its electoral process. In conducting a free and credible election, the process must be transparent to be adjudged credible. The electioneering process begins with the compilation of a voter register; this register contains the details of every eligible voter as stipulated by law or guild lines that guilds the electoral process. As part of what makes up, the guidelines are age restrictions for every intended voter. It is forbidding by law in most countries for a child to register as a voter, but this is not so in reality in most countries, especially in a developing nation. Because the age restriction is not obeyed, this has resulted in the incidences of underage voters and disputed election outcomes. This work provides an efficient and effective solution for the above concerns, using multiple digital solutions. The model will be integrating a deep learning Convolutional Neural Network (CNN), an Interplanetary File System (IPFS), and an Ethereum Smart Contract Blockchain. The role of the CNN is to detect any underage individual who intends to register as a voter. The CNN is built with a pretrained dataset, and it was trained with an age classifier that grouped the age on the images on the data set into eight distinct groups. This age grouping will help the age predictive algorithm estimate and place every image on the camera in a unique age group. This will only produce a binary result, which is "eligible to voter or not eligible to vote." This outcome is based on the preset threshold cut-off on the age group. The Interplanetary File System (IPFS) will provide a large storage capacity that will allow for off-chain data storage and still provide the model with all the functionalities and benefits of the blockchain. It also provides a hashing function that will assign and identify every registered voter with a unique cryptographic Identity. This ID will prevent the storage of the same information into the database, in so doing, eliminating multiple voting. Finally, the blockchain will provide a voting platform where the model will be implemented. It will allow every registered voter with a unique ID to create an account and vote on the blockchain. The adapted CNN was tested and evaluated and shows 85.9% performance accuracy, and when compared against two other age predictive models, it recorded an increase of 1.2%. In comparison, the complete digital solution model recorded 95.3% in performance. We believe this model will perform even better when subjected to further research work.

***Keywords:*** *Deep Learning, IPSF, CNN, Blockchain, Smart Contract, Age Estimation, E-Voting*