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

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OCTOBER, 2021

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE (M.Sc) DEGREE IN COMPUTER SCIENCE IN THE DEPARTMENT OF COMPUTER AND INFORMATION SCIENCES, COLLEGE OF 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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Prof. Akan B. Williams
(Dean, School of Postgraduate Studies) **Signature and Date**

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.

ACKNOWLEDGEMENTS

I am grateful to the God of heaven and earth, for counting me worthy to attain this level in my life. I am grateful Lord as I acknowledge as the source of all wisdom and knowledge.

My sincere appreciation goes to the Chancellor and the Chairman of the Board of Regent, Covenant University, Dr. David Oyedepo for providing both the spiritual and academic platform for me to advance my life.

My unreserved and sincere gratitude goes to my Supervisor, Professor Victor C. Osamor, for the advice, patience, guidance, love and commitment showed me towards the completion of this work. I am truly grateful sir, and may God richly bless you. I also want to specially thank all members and faculty and staff of Department of Computer and Information Sciences, led by the Head of Department Dr. Olufunke O. Oladipupo.

I am indeed grateful to my Parents. Mr. Andrew Nwankwo and Mrs. Catherine Nwankwo, they the one major reason why I am what I am today. There are no words that will be enough to show my appreciation to you both. May God almighty continue to keep you both alive and good health so you can continue to reap the fruits of your labor. My sincere gratitude will also go to my sibling, my brothers Mr. Okwudili Nwankwo, Mr. Oluchukwu Nwankwo, Mr. Toochukwu Nwankwo, and my sisters Mrs. Obiageli Nzukwe and Mrs. Eberechukwu Iloh. May bless you all for your support.

Finally, I want to sincerely appreciate my wife Mrs. Nonye Chukwuma-Nwankwo and our daughter Miss Mmachukwu Chukwuma for the support, tolerance and understanding al through the period of this work. May God bless you both abundantly.

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LIST OF ABBREVIATIONS

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

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

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