INTEGRATED WEBSITE USABILITY EVALUATION MODEL USING FUZZY ANALYTICAL HIERARCHY PROCESS AND ARTIFICIAL NEURAL NETWORK

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ABSTRACT

Numerous websites in this contemporary time have been plagued with many usability issues which have hitherto made the websites not effective and efficient for users while searching for information. Consequently, different website usability evaluation models have been proposed to help in evaluating websites. However, most existing models are rather too ambiguous and not easy to use. Also, selecting and ranking websites based on usability with respect to numerous criteria have become a very important decision-making process among users. Additionally, there is no existing machine leaning model developed to classify websites usability based on user's rating due to lack of usability ratings data. This thesis therefore proposes a new integrated usability evaluation model using Fuzzy Analytical Hierarchy Process (FAHP) with Artificial Neural Network (ANN). Five criteria of Speed (S_{pd}), Navigation (N_{av}), Ease-of-use (E_{ou}), Content (C_{on}) and Aesthetic (A_{es}) obtained through factor extraction out of initial seven criteria proposed are used in the study. Six Nigerian universities websites with good webometrics ranking are used as alternatives. These are University of Ibadan (UI), Covenant University (CU), Obafemi Awolowo University (OAU), University of Nigeria Nsukka (UNN), University of Lagos (UNILAG) and Ahmadu Bello University (ABU) websites. Two sets of usability data were collected via google forms from 233 and 169 participants. Results from FAHP indicates that UI website has the highest global priority weight and hence is ranked as number one. This is followed by CU, OAU, UNILAG, UNN and ABU websites respectively. Also, final criteria weights obtained are $0.321S_{pd}$, $0.208N_{av}$, $0.197E_{ou}$, $0.166C_{on}$ and $0.108A_{es}$ respectively. This implies that the first and most important criteria to website users is speed. Weights obtained from FAHP model were preprocessed and used to train six machine learning algorithms which are Artificial Neural network (ANN), Random Forest (RF), Decision Tree (J48), Simple Logistic regression (SLOG), Bayesian Network (BaNET) and Logistic Model Tree (LMT). Results show that ANN has the best overall performance with accuracy (A_{cc}) of 93.36% while RF, LMT, SLOG, J48 and BaNET have 90.12% A_{cc}, 88.09% A_{cc}, 88.18%A_{cc}, 88.18% A_{cc} and 83.63% A_{cc} respectively. The FAHP model is further integrated with ANN to classify the user's websites usability ratings. The ANN structure is 5-3-1 with logsig and trainbr as activation and transfer functions respectively. The best performance was obtained at learning rate (*l*) of 0.8, momentum (*m*) of 0.9 and threshold value(*h*) of 0.59. Further results obtained shows a precision (P_{re}), recall (R_{ec}) and F-measure (F_{me}) values of 98.44%P_{re} and 95.45%R_{ec} and $0.96F_{me}$ respectively. It is recommended that this integrated model, which can be used for users' websites usability evaluation, ranking and prediction be adopted by IT practitioners and web developers.

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ABBREVIATIONS

ACSI:	American Customer Satisfaction Index
AHP:	Analytical Hierarchy process
ANN:	Artificial Neural Network
ANP:	Analytical Network Process
ARTF	Attribute Relation File Format
AUC	Area Under Curve
BaNET:	Bayesian Network
CP:	Comparison Matrix
CSV	Comma Separated value
DEMATEL	Decision Making Trial and Selection Laboratory
ELECTRE:	Et Choix Traduisant la Réalité or Elimination and Choice Translating Reality
EON:	Ease of Navigation
EOU:	Ease of Use
EUM	Enhanced Usability Model
IEEE	Institute of Electrical and Electronics Engineers
ISO:	International Standard Organisation
LMT:	Linear Model Tree
LWM:	Linear Weighted Method
MAUT	Multi Attribute Utility Theory
MCDA;	Multi-Criteria Decision Analysis
MCDM:	Multi-Criteria Decision Making
MODM	Multi-Objective Decision Making

NHM:	New Hybrid Model
NIS	Negative Ideal Solution
OR	Operation Research
PCM:	Pairwise Comparison Matrix
PIS	Positive Ideal Solution
PROMETHEE:	Preference Ranking Organization METHod for Enrichment Evaluations
QFD:	Quality Function Deployment
QUIM	Quality in Use Model
RF:	Random Forest
RT:	Response Time
SLOG:	Simple Logistic Model Tree
TOPSIS:	Technique for Order of Preference by Similarity to Ideal Solution
UE	Usability Evaluation
UE:	Usability Evaluation
UMM	Usability Measurement Model
VIKOR	Vlse Kriterijumska Optimizacija I Kompromisno Resenje
WDBA:	Weighted Distance Based Approximation
WUE:	Website Usability Evaluation
WUEM	Web Usability Evaluation Model
WVA	Wavelength Variant Analysis