# ALL SCIENCES PROCEEDINGS



Year: 2023 Volume: 1 ISBN: 978-605-72325-7-1 2nd International Conference on Scientific and Academic Research ICSAR 2023

March 14-16, 2023: Konya, Turkey

MARCH 14-16, 2023, KONYA, TURKEY

https://www.icsarconf.com/

# PROCEEDING BOOK OF 2ND INTERNATIONAL CONFERENCE ON SCIENTIFIC AND ACADEMIC RESEARCH

# PROCEEDING BOOK OF 2ND ICSAR 2023:

Editors:

Asst. Prof. Dr. Umut Özkaya

14-16 March 2023 Konya, Turkey Publication date: 22.03.2023

#### MARCH 14-16, 2023, KONYA, TURKEY

As this is a serial book published annually, it has ISBN. ISBN links to a series of proceeding based on 1st International Conference on Trends in Advanced Research ICSAR 2023.

Please use the following format to cite material from this book: Author, A., A. & Author, B., B. (2023, March). Tittle of Paper, *In International Conference on Scientific and Academic Research*, (Vol. 1, pp. xx-xx).

ISBN 978-605-72325-7-1

International Conference Website

https://www.icsarconf.com/

Publication of record for individual papers is online in the ASP Digital Library: as-proceeding.com. This website is used to distribute the articles into various databases. For citing online articles please use ISBN.

## **Copyright information:**

Authors retain copyright and grant the journal right of first publication with the work simultaneously licensed under a Creative Commons Attribution License 4.0 (CC BY 4.0) that allows others to share the work with an acknowledgement of the work's authorship and initial publication in this journal.

Authors are able to enter into separate, additional contractual arrangements for the non-exclusive distribution of the journal's published version of the work (e.g., post it to an institutional repository or publish it in a book), with an acknowledgement of its initial publication in this journal.

Authors are permitted and encouraged to post their work online (e.g., in institutional repositories or on their website) prior to and during the submission process, as it can lead to productive exchanges, as well as earlier and greater citation of published work.

#### INTRODUCTION

We had the great honor of organizing the 2nd International Conference on Scientific and Academic Research ICSAR 2023. It was truly a great pleasure for us to greet a lot of participants from many different countries attending ICSAR 2023! We firmly believe that the conference will become an important international event in the field of cross-industry discussion about innovations in Academic Studies.

ICSAR 2023 was organized by All Science Academy located in Konya, Turkey.

Three cooperating organizations supported the four-day conference. There were 275 papers accepted for presentation at ICSAR 2023, contributed from different countries. We had plenary speeches and several well-known scientists and experts, to give invited talks at different sessions.

The purpose of ICSAR 2023 was to provide a forum for the participants to report and review innovative ideas, with up-to-date progress and developments, and discuss novel approaches to the application in the field of their own research areas and discuss challenges of doing science.

We sincerely hope that the exchange of ideas on doing research, science and improving education will help the participants, and international cooperation sharing the common interest will be enhanced.

On behalf the Organization Committee of ICSAR 2023, we would like to heartily thank our cooperating organizations for all they have done for the conference. We would also like to thank the authors for their contribution to the proceedings; the participants and friends of ICSAR 2023, for their interest and efforts in helping us to make the conference possible; and the Editorial boards for their effective work and valuable advice, especially the ICSAR 2023 secretariat and the ICSAR 2023 staff, for their tireless efforts and outstanding services in preparing the conference and publishing the Proceedings.

Asst. Prof. Dr. Umut Özkaya

Conference chairs

## TABLE OF CONTENTS

I
Ш
XII
XIII
XIV
XV

Table List of Content										
Content of Full Papers										
Page No	Title	Authors	Country	Submission ID						
1-4	KUR'AN'DA GEÇEN BEYT-İ MA'MUR KAVRAMININ ANLAM ALANI	Yakup Yüksel	Turkey	Mail Submission 1						
5-8	MÜFESSİR EBÛ HAYYÂN'IN HANÎF KELİMESİ HAKKINDAKİ YORUMLARI	Yakup Yüksel	Turkey	Mail Submission 2						
9-15	Köpeklerde medetomidin/ketamin ve medetomidin/propofol anestezi ve etkilerinin atipamezol ile tersine çevrilmesinin ekokardiografik verilerdeki etkilerinin karşılaştırılması	Murat Kibar	Turkey	Mail Submission 11						
16-21	Doğal Afet Sonrası Gelişen Post-Travmatik Stres Bozukluğu ve Fizyoterapi Yaklasımları	Müşerref Ebru ŞEN	Turkey	Mail Submission 5						
22-25	Kıyı Bölgesinde Tuzluluk Girişiminin Laboratuvar Ölçekli İncelenmesi	Ayşe Nur KARAYEL, Babak VAHEDDOOST	Turkey, Turkey	Submission 120						
26-27	Suitable Ambient Condition Ranges for Solar Assisted Heat Pump Types	Kutbay Sezen	Turkey	Submission 130						
28-33	E-postalarda Spam Kontrolü İçin QR Barkod Tekniğiyle işlenmiş Verilerin Artık Bloklu Derin Öğrenme Modelleriyle Analizi	Mesut Toğaçar, Burhan Ergen	Tukey, Turkey	Submission 158						
34-36	Dual Fibonacci ve Lucas 3-Parametreli Genelleştirilmiş Kuaterniyonları	Zafer ÜNAL	Turkey	Submission 182						
37-45	KADINA YÖNELİK ŞİDDETİN EMZİRME ÜZERİNE ETKİSİ	Hatice ÖZKAN, Emine GERÇEK ÖTER	Turkey, Turkey	Submission 184						
46-50	A FAST EMPIRICAL-BASED METHODOLOGY TO CALCULATE ADDED RESISTANCE	Emre Kahramanoglu, Gokhan Budak	Turkey, Turkey	Submission 191						
51-57	Determining the Parameters of the Controllers of the TRMS System Using The Cuckoo Algorithm	Eren İzcier, Mehmet Nuri Almalı, İshak Parlar and Ali Can Çabuker	Turkey, Turkey, Turkey, Turkey	Submission 192						
58-63	Oscillation-based Linear Dynamic Sampling Allocation for Noisy Multiobjective Optimization Problems	Tolga Altinoz	Turkey	Submission 252						
64-76	Mobbingin İşe Angaje Olmaya Etkisi	Turhan Moç, Yasin Erçetin	Turkey, Turkey	Submission 255						
77-82	Application of Machine Learning on Wind Blowing Speed	Akin Ilhan	Turkey	Submission 269						
83-86	An inclusive discussion about chip shape during turning of the Nimax steel	Rüstem Binali, Havva Demirpolat and Mustafa Kuntoğlu	Turkey, Turkey, Turkey	Submission 276						
87-90	Yenilenebilir Enerji Sistemlerinde Kullanılan Güç Elektroniği Devrelerinde Mikrodenetleyici Giriş Geriliminin Regülasyonu için Kullanılan Tekniklerin Karşılaştırılması	Kerim KARABACAK	Turkey	Submission 277						
91-94	Antibiotic Resistant Profile of Enteric Bacteria Isolated from Chicken Meats	Ebru Başaran, Nurcihan Hacıoğlu Doğru	Turkey, Turkey	Submission 278						
95-99	Development of Environmentally Friendly Tea Compost from Raw Tea Waste Using Biotechnological Method	Ayhan Kocaman, Metin Turan	Turkey, Turkey	Submission 290						
100-104	OBEZ KADINLARDA KİLO VERMENİN İNFERTİLİTE ÜZERİNE ETKİSİ: BİR LİTERATÜR ARAŞTIRMASI	İrem AKTAŞ, Emine GERÇEK ÖTER	Turkey, Turkey	Submission 309						
105-113	BAZI YAĞLIK AYÇİÇEĞİ (Helianthus annuus L.) ÇEŞİTLERİNDE FARKLI AZOT DOZLARININ VERİM VE VERİM UNSURLARI ÜZERİNE ETKİLERİ	Özden Öztürk, Merve Nur İnce Yıldız	Turkey, Turkey	Submission 320						
114-120	The traditional control of Brushless Doubly-Fed Reluctance Machines	Oualah Oussama, Kerdoun Djallel and Boumassata Abderraouf	Algeria, Algeria, Algeria	Submission 321						
121-123	Alkali İyileştirmenin Muz lifi Takviyeli Polioksimetilenin Eriyik Akış İndeksi Üzerindeki Etkisinin İncelenmesi	Akar DOGAN, Çağdaş GÜNEŞ	Turkey, Turkey	Submission 323						
124-131	Layered Architecture of Internet of Things-A Review	Muhammad Awais, Jawaid Iqbal	Pakistan, Pakistan	Submission 362						
132-138	Detection of Cardiovascular Diseases with CNN- LSTM Based Model Using Different Evaluation Parameters	Harun Bingol, Muhammed Yildirim	Turkey, Turkey	Submission 363						

#### 2ND INTERNATIONAL CONFERENCE ON SCIENTIFIC AND ACADEMIC RESEARCH ICSAR 2023

MARCH 14-16, 2023, KONYA, TURKEY

https://www.icsarconf.com/

139-144	Violence Activity Detection Classification - A Review	Muhammad Awais, Sara Durrani	Pakistan, Pakistan	Submission 370
145-147	Bohr Radius For A Certain Subclass Of Harmonic Functions	Merve NAS, Sibel YALÇIN and Hasan BAYR AM	Turkey, Turkey, Turkey	Submission 372
148-152	Application of Electrooxidation Technology in the Treatment of Paper Industry Wastewater: The Effect of pH and Current Density	Baybars Ali Fil, Cansu Elgün and Süleyman Uzuner	Turkey, Turkey, Turkey	Submission 375
153-160	Toz metalurjik Ti6Al4V alaşımının bilyalı dövme sonrası yüzey ve yüzey altı mekanik ve mikroyapısal özelliklerinin incelenmesi	Emirhan Çalım, Yasemin Yıldıran Avcu, Eleftherios Iakovakis, Eray Abakay, Rıdvan Yamanoğlu, Funda Gül Koç, Mert Guney, Egemen Avcu	Turkey, Turkey, England, Turkey, Turkey, Turkey, Kazakhistan, Turkey	Submission 383
161-167	Dermoskopik Görüntülerden Melanom Tespitinde Hiyerarşik Derin Özelliklere İlişkin Performans Karşılaştırması	Hasan Polat	Turkey	Submission 390
168-173	Marka Aşkının Ağızdan Ağıza İletişim Üzerindeki Etkisinde Marka Sadakatinin Aracılık Rolünün İncelenmesi	İbrahim Aydın, Zübeyir Çelik	Turkey, Turkey	Submission 403
174-180	Dr. Refik Saydam'dan Günümüze Sağlık Alanındaki Gelişim: 100 Yıl	Oya Ögenler, İnci Akalper, Selda Okuyaz	Turkey, Turkey, Turkey	Submission 407
181-188	Hayat Eve Sığar (HES) Uygulamasının Kullanılabilirlik Analizi	M. Hanefi CALP, Resul BÜTÜNER	Turkey, Turkey	Submission 408
189-195	Gümüşhane katı atık toplama sahası ve yakın çevresinde ağır metal kirliliğine maruz bölgede yetişen civanperçemi (Achillea millefolium L.) bitkisinin element biriktirme kabiliyeti (Gümüşhane, KD Türkiye)	Alaaddin Vural, Abdullah Kaygusuz	Turkey, Turkey	Submission 410
196-200	NONLİNEER YAKLAŞIMLA BİTKİLERİN ELEMENT BİRİKTİRME POTANSİYELİNİN HESAPLANMASI: TİTREK KAVAK (POPULUS TREMULA) YAPRAKLARININ Sr, Ba, La, Cd BİRİKTİRME KABİLİYETİ ÖRNEĞİYLE	Zafer Çakır, Alaaddin Vural	Turkey, Turkey	Submission 411
201-208	DESIGN AND CONSTRUCTION OF AUTOMATIC STREET LIGHT BASED ON VEHICLE MOVEMENT	Auwal Salisu Yunusa, Mariya G. Mustapha, Auwal R. Dan Sharif, Mujittapha I. Wawo, Shehu Atiku, Nafisa Tijjani, Aliyu Musa Sani, Aliyu Sani Yahaya, Umar Shehu	Nigeria, Nigeria, Nigeria, Nigeria, Nigeria, Nigeria, Nigeria, Nigeria, Nigeria	Submission 413
209-214	Büyükaktaş Diyoritinin (Bayburt) Genel Jeolojik ve Petrografik Özellikleri	Alaaddin Vural, Abdullah Kaygusuz	Turkey, Turkey	Submission 414
215-219	Modeling of fatigue crack growth by neural networks	Abdelfetah MOUSSOUNI, Nadjia BENACHOUR and Mustapha BENACHOUR	Algeria, Algeria, Algeria	Submission 415
220-223	DESIGN OF A FINGER PRINT SCAN DOOR USING ARDUINO ATMEGA 328P AT KANO STATE POLYTECHNIC, NIGERIA	Mariya G. Mustapha, Auwal S. Yunusa, Auwal R. Dan Sharif, Auwal Usman, Shehu Atiku, Nafisa Tijjani, Aliyu Sani Yahaya, Usman Haruna	Nigeria, Nigeria, Nigeria, Nigeria, Nigeria, Nigeria, Nigeria, Nigeria	Submission 420
224-227	S-rGO/Fe2O3/PPy nanocomposite formation for 2032 SupercapBattery Applications	Murat ATES	Turkey	Submission 434
228-231	SupercapBattery performances of rGO/NiO/PPy nanocomposite in ionic liquid electrolyte	Murat ATES	Turkey	Submission 435
232-237	SPECTRUM OCCUPANCY PREDICTION USING A MODIFIED XGBOOST MACHINE LEARNING ALGORITHM	Temitayo Ayodeji OYEWO, Omar Suleiman DAUDA and Abubakar Saddig MOHAMMED	Nigeria, Nigeria, Nigeria	Mail Submission 8
238-243	Ethical guide to total quality management	Işık ÇİÇEK, Nasrin Mohammadi	Turkey, Turkey	Submission 395
244-249	Iers Yüz Oğrenme IIe İlgili Yapılan Lisansüstü Çalışmaların İncelenmesi: Bir Eğilim Araştırması	Oğuzhan Sevim, Ahmet Karabulut	Turkey, Turkey	Submission 441
250-255	Ortaokul Oğrencilerinin Ev Ödevlerine İlişkin Görüşlerinin İncelenmesi	Oğuzhan Sevim, Ahmet Karabulut	Turkey, Turkey	Submission 442
256-259	Level of formal and informal communication in TQM Circles to total quality management	GÜLNUR ÇALIŞKAN, IŞIK ÇİÇEK	Turkey, Turkey	Submission 530
260-262	Bir Mikromorfolojik Yapıda Geometri	Ali Özdemir	Turkey	Submission 451
263-269	A Novel Method for Classification of Butterfly Species Using CNN	Halit Çetiner	Turkey	Submission 454
270-273	Structural Investigation of a Hydrazide Derivate Compound Including Pyridine Ring	Sevgi Kansız	Turkey	Submission 455
274-277	POLİSTİREN KÖPÜK VE KESME DONATILI BETONARME DÖŞEMELERİN DENEYSEL ARAŞTIRILMASI	FIRAT KIPÇAK, MUCİP TAPAN, ABDULHALİM KARAŞİN, BARIŞ ERDİL	Turkey, Turkey, Turkey, Turkey	Submission 462
278-282	Design of a deep neural network for diabetes prediction	FERAS KHALEL, NEHAD T.A RAMAHA	Turkey, Turkey	Submission 463
283-286	Use of Morphine for Palliative Care based on their prescription	Dorina Dervishi, Emi Panariti	Albania, Albania	Submission 465
287-291	Analysis on the capacitance characteristics of an Au/WOx/nSi junction	Murat GÜLNAHAR	Turkey	Submission 473
292-295	Bir Au/MoOx/n-Si çoklu eklem yapının yüksek frekanslarda kapaşitans-gerilim karakteriştikleri	Murat GÜLNAHAR	Turkey	Submission 475



2<sup>nd</sup> International Conference on Scientific and Academic Research

March 14-16, 2023 : Konya, Turkey



© 2023 Published by All Sciences Proceedings

# SPECTRUM OCCUPANCY PREDICTION USING A MODIFIED XGBOOST MACHINE LEARNING ALGORITHM

Temitayo Ayodeji OYEWO<sup>1\*</sup>, Umar Suleiman DAUDA<sup>1</sup> and Abubakar Saddiq MOHAMMED<sup>2</sup>

<sup>1</sup>Department of Electrical/Electronic Engineering, Federal University of Technology Minna, Nigeria. <sup>2</sup>Department of Telecommunication Engineering, Federal University of Technology Minna, Nigeria.

\* (teteyeah4u@yahoo.com) Email of the corresponding author

*Abstract* – There is an alarming rate of growth in the usage of spectrum, where some of the allocated spectra is fully engaged while others are sparsely utilized. This gives attention to the use of cognitive radios where the Primary users can maximize the available spectrum holes alongside the secondary users. The challenge of using cognitive radio technology is interference which is a factor that causes a delay in the handoff time. XGBoost alongside other regression Machine Learning (ML) Algorithm such as linear Regression, Lasso Regression, Ridge regression, and the random forest was used to train and predict the dataset gotten from sensing the spectrum at a location called Morris Fertilizer within the environs of Minna, Niger state. Linear regression, Random forest regression, XGBoost, Ridge, and Lasso have been used for the prediction of cognitive radio frequencies based on 10 power features.

The linear Regression, Ridge and Lasso gave the same level of accuracy of 6.39%, while Random forest gave an accuracy of 54.65%Xgboost gave the best performance with an accuracy level of 96.85%, thus boosting algorithm shows a high level of prediction ability.

Keywords: Cognitive Radio, Spectrum Sensing Energy Detector, Machine Learning Algorithm.

## I. INTRODUCTION

The current exponential growth in technological advancements has led to an increased demand for wireless devices. This surge in demand, coupled with the static management of the radio spectrum, has resulted in a shortage of available spectrum. This shortage is due to the inefficiency of the static management of the spectrum, which is unable to accommodate the growing number of wireless devices. [1] Observed that most current wireless communication systems are based on the concept of fixed frequency allocation. The quality-ofservice (QoS) criteria of the radio spectrum are met while consuming less energy thanks to cognitive radio (CR) technology [2]. Machine learning (ML) algorithms are used to mimic human intelligence and they can make decisions without explicit programming [3]. The use of ML algorithms in CR

technology improves both the efficiency and effectiveness of spectrum utilization [4] & [5]. [6] Worked to minimize the delay that occurs during spectrum handoff. To increase the time and energy efficacy of Spectrum Sensing [7] reduced the number of channels used for sensing with spectrum prediction. [8] Shows that XGBoost outperforms a number of other well-known machine learning methods such as the linear Regression, Lasso Regression, Ridge regression and random forest on a range of datasets from a spectrum sensing of frequency range between 80MHz to 2GHz. The analysis carried out shows the XGBoost ML algorithm has the ability to work better with a large dataset, whereas the other regression ML algorithm seems to be limited.

# II. MATERIALS AND METHODS

The system design consists briefly of two major stages: (a) the spectrum sensing stage. (b). the data analysis with the ML algorithm for the prediction of spectrum holes (XGBoost). To collect data to run analysis, a high-gain outdoor antenna with an acceptable capability frequency range of 80MHz to 2GHz was connected to the spectrum analyzer to capture electromagnetic signals.

The components used for the collection of data are as follows:

Antennae, which enables the spectrums analyzer to capture electromagnetic waves. Table 1 shows the frequency band and allocations that were analyzed An Agilent spectrum Analyzer N9342C, A personal computer, and a backup power supply (generator) to sustain the sensing process for the period of the exercise. The Global Position System (GPS) was used to determine the location where the exercise was carried out. Figure 1 shows a block diagram of components. The dataset collected as CSV files at collated in a spreadsheet and imported into the Python 3.0 Jupyter.

The dataset was checked to know the type if it was a discreet or classification (yes or no) problem.

The dataset from the spectrum sensing exercise is continuous. Which means it is a regression problem. The correlation was visualized using the heat map representation as shown in figure 6. After this, the correlation between the dataset was checked. The dataset was divided into training and testing datasets. To train the dataset 80% of the dataset was used to train while the other 20% was used to test the functionality of the prediction exercise. The dataset was grouped into the predictor and the target (what is being predicted). The target is the frequencies of the analyzed spectrum in Hz and the predictors are the powers in -dB. Using powers to predict frequencies. The Linear regression, Random forest regression, Ridge and Lasso was trained and tested with the dataset until the XGBoost gave a high percentage accuracy level and prediction.

Table 1 Frequency band and allocations analyzed

FREQUENCY RANGE	SERVICE
88 - 108 MHz	FM Radio Broadcast
108 - 200 MHz	Navigation (VOR), Aeronautical Navigation, Military Land Mobile, Amateur Radio , Land Mobile (VHF)
200 - 400 MHz	Land Mobile (VHF), Fixed & Land Mobile Military Aviation
400 - 600 MHz	Land Mobile (UHF), Amateur Radio, Land Mobile (UHF), TV Channels 14 – 20, TV Channels 21 – 36
600 - 960 MHz	Land Mobile (UHF), TV Channels 38 – 51, Public Safety & Commercial Wireless
960 – 2000 MHz	Microwave Communication, GPS, Bluetooth, Wi-Fi



Figure 3 Random Forest

In [26]: rf\_random = RandomizedSearchCV(estimator = rf, param\_distributions = random\_grid, scoring = 'neg\_mean\_squared\_error', n\_iter = 100, cv = 5, random\_state = 1) In [27]: rf random.fit(Train X, Train Y) Out[27]: RandomizedSearchCV(cv=5, estimator=RandomForestRegressor(), n\_iter=100, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500]}, random\_state=1, scoring='neg\_mean\_squared\_error') In [28]: pred\_train\_rf = rf\_random.predict(Train\_X) print(np.sqrt(mean\_squared\_error(Train\_Y, pred\_train\_rf))) train\_score = r2\_score(Train\_Y, pred\_train\_rf) print("The train accuracy score (R2) of the Random Forest Regression is: {0:.2f}%".format(train\_score \*100)) 374461472.50481296 The train accuracy score (R2) of the Random Forest Regression is: 54.85% In [29]: from xgboost import XGBRegressor In [30]: predictors = [x for x in Train\_X.columns] xgb1 = XGBRegressor(

XgD1 = XGBRegressor( learning\_rate =0.1, n\_estimators=1000, max\_depth=5, min\_child\_weight=1, gamma=0, subsample=0.8, colsample\_bytree=0.8, nthread=4, scale\_pos\_weight=1, seed=27) xgb1.fit(Train\_X, Train\_Y) Out[30]: XGBRegressor(base\_score=None, booster=None, callbacks=None,

colsample\_bylevel=None, colsample\_bynode=None, colsample\_bytree=0.8, early\_stopping\_rounds=None, enable\_categorical=False, eval\_metric=None, feature\_types=None, gamma=0, gpu\_id=None, grow\_policy=None, importance\_type=None, interaction\_constraints=None, learning\_rate=0.1, max\_bin=None, max\_cat\_threshold=None, max\_cat\_to\_onehot=None, max\_delta\_step=None, max\_depth=5, max\_leaves=None, mi\_child\_weight=1, missing=nan, monotone\_constraints=None, n\_estimators=1000, n\_jobs=None, nthread=4, num\_parallel\_tree=None, predictor=None, ...)

Figure 4 XGB Regressor



Figure 5 The lasso Regression

# IV. DISCUSSION

The dataset was collected based on laboratory experiments and using the excel tool we did some data preprocessing, before importing the data into python where further data preprocessing, exploratory data analysis(EDA), and feature engineering was carried out. Thus, we proceed to model training using some machine learning algorithm.

In this machine learning model, five different algorithms namely; Linear regression, Random forest regression, XGBoost, Ridge, and Lasso has been used for the prediction of cognitive radio frequencies based on 10 power features.

The linear Regression, Ridge and Lasso gave the same level of accuracy of 6.39%, while Random forest gave an accuracy of 54.65% Xgboost gave the best performance with an accuracy level of 96.85%, thus boosting algorithm shows a high level of prediction ability and can be recommended for the

prediction of		f	cognitive				radio			frequencies				. 355
freq_in_Hz	1.00	-0.18	-0.15	-0.14	-0.13	-0.12	-0.15	-0.16	-0.17	-0.17	-0.17	-0.17		- 1.0
power_1	-0.18	1.00	0.92	0.92	0.92	0.93	0.97	0.97	0.96	0.96	0.96	0.94		
power_2	-0.15	0.92	1.00	0.97	0.97	0.97	0.90	0.90	0.88	0.89	0.90	0.87		- 0.8
power_3	-0.14	0.92	0.97	1.00	0.98	0.98	0.91	0.90	0.88	0.89	0.89	0.87		
power_4	-0.13	0.92	0.97	0.98	1.00	0.98	0.91	0.91	0.88	0.89	0.89	0.87		- 0.6
power_5	-0.12	0.93	0.97	0.98	0.98	1.00	0.91	0.91	0.88	0.89	<b>0</b> ,89	0.87		
power_6	-0.15	0.97	0.90	0.91	0.91	0.91	1.00	0.97	0.96	0.97	0.96	0.95		- 0.4
power_7	-0.16	0.97	0.90	0.90	0.91	0.91	0.97	1.00	0.96	0.96	0.96	0.94		
power_8	-0.17	0.96	0.88	0.88	0.88	0.88	0.96	0.96	1.00	0.98	0.97	0.96		- 0.2
power_9	-0.17	0.96	0.89	0.89	0.89	0.89	0.97	0.96	0.98	1.00	0.97	0.96		
power_10	-0.17	0.96	0.90	0.89	0,89	0.89	0.96	0.96	0.97	0.97	1.00	0.95		- 0.0
power_11	-0.17	0.94	0.87	0.87	0.87	0.87	0.95	0.94	0.96	0.96	0.95	1.00		
	req_in_Hz	power_1	power_2	power_3	power_4	power_5	power_6	power_7	power_8	power_9	power_10	power_11		
Figure 6 The Heat Map														

# V. CONCLUSION

Sensing the spectrum to know the level of occupancy, for a cognitive radio user to engage the spectrum holes, can have certain setback which the

handoff time leads to the interference of the secondary user with the primary user. This factor affects the quality of service of the spectra.

This brought about the idea to collate a set of data from the system which can be used to train a machine learning model to be able to predict the spectrum holes.

A well-built and tested model will increase the quality of service of the spectrum sensed, thereby giving better reliability for users when transmitting.

## REFERENCES

- A. Nasser, H. A. H. Hassan, J. A. Chaaya, A. Mansour, and K. C. Yao, "Spectrum sensing for cognitive radio: Recent advances and future challenge," *Sensors*, vol. 21, no. 7, pp. 1–29, 2021, doi: 10.3390/s21072408.
- [2] L. Chen, Y. Zhu, G. Papandreou, and F. Schroff, "Encoder-Decoder with Atrous Separable Convolution for Semantic Image Segmentation".
- [3] I. J. Goodfellow, J. Pouget-abadie, M. Mirza, B. Xu, and D. Warde-farley, "Generative Adversarial Nets," pp. 1–9,2016.
- [4] M. Saber, A. El Rharras, R. Saadane, A. Chehri, N. Hakem, and H. A. Kharraz, "Spectrum sensing for smart embedded devices in cognitive networks using machine learning algorithms," *Procedia Comput. Sci.*, vol. 176, pp. 2404–2413, 2020, doi: 10.1016/j.procs.2020.09.311.
- [5] S. Solanki, V. Dehalwar, and J. Choudhary, "Deep learning for spectrum sensing in cognitive radio," *Symmetry (Basel).*, vol. 13, no. 1, pp. 1–15, 2021, doi: 10.3390/sym13010147.
- [6] E. Alozie, N. Faruk, A. A. Oloyede, O. A. Sowande, and A. Lucky, "Intelligent Process of Spectrum Handoff in Cognitive Radio Networks," vol. 4, no. 1, pp. 205–218, 2022.
- [7] A. Unadhye, P. Saravanan, S. S. Chandra, and S. Gurugopinath, "A Survey on Machine Learning Algorithms for Applications in Cognitive Radio Networks," *Proc. CONECCT 2021 7th IEEE Int. Conf. Electron. Comput. Commun. Technol.*, 2021, doi: 10.1109/CONECCT52877.2021.9622610.
- [8] T. Chen and C. Guestrin, "XGBoost : A Scalable Tree Boosting System," pp. 785–794, 2016, doi: 10.1145/2939672.2939785.