Emergent use of Social Media on Elections: the use of Data Mining and Social Network Analysis for Political Purposes

Zakia Acharoui, Badia Ettaki, Jamal Zerouaoui

Abstract: People spend more time on social media either for personal or social interest which generates an expanding amount of Data. This paper is written for researchers seeking to have an overview of the different technical methods used for political purposes principally Data Mining and Social Network Analysis. Hence, the first part introduces the impact of Social Media on politics for different aims such as communicating with voters, promoting participation, and predicting election results, then the two main methods to achieve political purposes were presented. Data mining approaches is likely to be used on political context to classify citizen's opinion or predicting results thus by using methods such as term occurrence, mentions, Support Vector Machine, Machine Learning, and Artificial Neural Networks. The Social Network Analysis approaches are used to retrieve data about influencers, their role during a period, and the nature of the information shared.

Keywords: Social Media; Data Mining; Social Network Analysis; Political Participation; Centrality Measures.

I. INTRODUCTION

The adoption of Social Media (SM) as a communication tool has created a new way of information propagation for different purposes. It becomes a sphere for people to share their personal feelings and views about public issues freely and without any restriction [1]. For instance, researchers show that SM plays a great role in spreading and obtaining information during disasters. Many risks and public issues have an international impact like transnational terrorism, pandemic disease, outbreaks, climate change, and some natural disasters [2] where people's opinions gather and form a strong public voice [3] to promote possible solutions or draw an overview about the current situation. In addition, the SM has been used in business as a source of information for consumers and a promotional tool for brands [4] [5]. And, on medicine SM has been used as a tool for public health surveillance and medicinal research [6].

In politics the SM is used for different purposes such as influence, promoting participation, communicating with voters, and predicting election results. The large amount of the raw data, produced on SM networks, becomes a great field for politicians and scholars to form an overview about people's opinions, and to predict results. For example, the information shared on Twitter has been used in decision making for election prediction [7][8].

Furthermore, politicians benefit from communicating directly and without mediation with citizens and potential voters. Which have encouraged them to consider the Internet as a new venue for self-presentation, outreach and campaigning. This paper aims to present the use purposes of SM on politics and display the two main methods used to satisfy the field needs and politicians' intentions.

II. USE OF SOCIAL MEDIA FOR POLITICAL

The impact of SM on political activities was widely significant as its influence has been detected on different aspects of civic and democratic processes. The decreased levels of electoral turnout [9], civic engagement and lack of trust in politicians and political parties [10] have caught scholars' attention to comprehend the reasons for these declining levels and, become a challenge for politicians and democracy representatives.

The SM wave has changed the citizens' behavior toward politics and political activities. While many scholars have pointed the positive impact of SM on political activities, other studies declare that the influence of SM is still minor.

For instance, Holt K. et al. [11] have suggested that the frequent use of SM among young citizens can be used to motivate political participation based on a study conducted during the 2010 Swedish national election campaign. Similarly, Effing R. et al. [12] have attested that during the national elections 2010, politicians with higher SM engagement got relatively more votes within most political parties compared to others.

In contrast, Hong S. & Nadler D. [13] claims that the effect of SM on Public attention is still minimal thus by testing the association between the "candidate salience" and the candidates' level of engagement in online social media. Also, the result of meta-analysis research, on SM use and participation, conducted by Boulianne S. [14] has shown that the impact of participation in election campaigns is still minimal.

∗ Correspondence Author

Acharoui Zakia∗, Laboratory of Materials Physics and Subatomics. Faculty of Sciences- Ibn Tofail University, Kenitra, Morocco. Email: zakia.acharoui@gmail.com

Ettaki Badia Laboratory of Research in Computer Science, Data Sciences and Knowledge Engineering , School of Information Sciences Rabat, Morocco, Email: ettakibadia@yahoo.fr

Zerouaoui Jamal, Laboratory of Materials Physics and Subatomics. Faculty of Sciences- Ibn Tofail University, Kenitra, Morocco.Email: j_zerouaoui@yahoo.fr

The SM has increased the amount and the availability of political discourse and content, thus investigating its impact on promoting social and political change remains a subject of many studies. In his study, Lee Paul S. N. et al. [15] have examined the role of social media during the Umbrella Movement in Hong Kong by interviewing a random sample over the phone before the end of the Umbrella Movement. The data showed that the acquisition of political news through SM was positively related to support for the Umbrella Movement and adversely with satisfaction and trust of established political authorities.

Similarly, Wolfsfeld G. et al. [16] have studies, on the case of Arab Spring, the role of SM in accordance with the political environment on which it operates; and, the relationship between the increasing use of SM with the raise of protest activity. The result has provided strong support for the validity of the claims.

Engaging citizens in democratic processes represents a challenge to politicians and social organizations due to the growing lack of trust in government institutions. The studies related to the relationship between SM use and democratic engagement have reported a positive link [10]. Moreover, Ahmed A. et al. [17] have confirmed that citizens are adopting SM platforms as tools for participation and collaboration for civic and democratic processes.

The influence of SM on vote action, citizen's engagement and perception have been also a subject of many studies. The changes in political views have been investigated by Lee, C. et al. [18] using panel data collected in South Korea between 2012 and 2016. The finding shows that although there were no direct effects of SM use, SM indirectly contributed to polarization through increased political engagement.

Thus, we can conclude that the users who actively used social media were more likely to be more informed about issues and then engage in political processes. For instance, Bui T. H. [19] has examined the patterns of use of SM and its roles in Vietnam's politics by adopting a qualitative method based on participant observation, a content analysis of websites, electronic newspapers, blogs, and government documents. The study result shows that the public has been better informed about key political and economic issues however the weight of influence varies from an actor to another and the SM space could be manipulated by powerful instances.

Other than engaging citizens in the political process, the SM has been used by candidates as a tool for self-promotion and media validation. This has been mentioned by Ahmed S. et al. [17] while investigating Twitter use during the 2014 Indian general elections. The findings show that the new-and-upcoming parties used Twitter for self-promotion and media validation, while established parties used it to supplement their offline strategies. Also, the winning party's electoral success is significantly associated with their use of Twitter for engaging voters.

In the same context, Karlsen R. & Bernard E. [20] have analyzed the relationship between individualization and digital SM by combining the 2013 Norwegian Candidate Survey with candidates' Twitter data. The findings show the existence of two main styles of SM campaigning: a party-centered and an individualized style. The candidates who use SM to focus on their own candidacy are not the most successful and influential candidates on Twitter. However, the candidates who are able to create a synergy between traditional media channels and SM gain more in terms of influence.

Other studies have been more interested on identifying the influencer's profile. For example, Larsson, A.O and Bente K. [21] have presented in their study the use of SM (Facebook and Twitter) by the politicians to the national parliaments of Norway and Sweden. The statistical analysis of the data collected shows that the use levels are low for both services and further analyses reveal that the most active politicians are more likely to be younger, in opposition and out of the political limelight.

On the other hand, other scholars were rather concerned by the subject and the topic that was addressed by politicians and candidates during the election campaigns on social networks [22][23].

The purpose behind using social media varies from an entity to another. Political parties were mainly interested in using SM to promote social and political change, rise citizens' engagement and influence the vote decision. Moreover, the SM was used by politicians was basically for self-promotion and media validation and by scholars to identify influencer's profiles and to retrieve the popular topics addressed by candidates.

The next section will expose the two main methods applied by scholars on social media in the political context.

III. EXPOSING THE MAIN METHODS USED FOR POLITICAL PURPOSES

A. Data Mining

Opinion mining is one of the famous methods used on politics to determine the opinion orientation of citizens on SM and to form an opinion summary. Thus, either by building a semantic orientation, of a text or a message, at words level [24], sentence-level [24], or by building a sentiment lexicon [25] [26]. For instance, Skoric M., et al. [27] have proposed word and term frequencies for tweets corresponding to key terms related to the subject, such as democratic leader names and democratic organization names which played an important role in predicting Singapore Elections 2011.

Similarly, Min S. and Min C. K. [28], attempted to mine the Twitter data in real-time Korean Elections 2012. The system offers the prediction based on terms occurrence and mentions-based social network analogy. The system reflects well for term calculation-based trend change in user opinion. They also take user mentions into account to predict the tend behavior. This tend behavior can help to find out the outcome of a topic in near time analysis.

On the other side, Changhua Y. has used emoticons assigned to blog posts to determine the mood of the users [29]. Also, Davidiv D. et al., [30] have proposed multiple sentiment types to classify tweets using hashtags and smileys as labels.

To mine opinion, scholars have used many classifiers. Gull R. et al. [31] have compared two classification techniques, Naïve Bayes algorithm and Support Vector Machines (SVM), to classify data on Twitter and determine positive, negative and neutral sentiments for the political parties of Pakistan.

The result shows that SVM performs better.

In his study, Anjaria M. al. [32] has compared different classification methods (SVM, Naive Bayes, Maximum Entropy and Artificial Neural Networks) on two different scenarios Presidential Elections-2012 and Karataka State Elections-2013 to validate prediction results. Combining Principal Component Analysis (PCA) with SVM has been helpful in reducing dimensions and achieving better accuracy but does not necessarily provide consistent output. Experimental results demonstrate that SVM outperforms all other classifiers.

Differently, Mahmood T. et al. [33] analyzed the impact of tweets in predicting the winner of the 2013 election held in Pakistan, by identifying relevant Twitter users and construct predictive models with the Chi-squared Automatic Interaction Detector that have shown more accuracy than the Naïve Bayes algorithm and the SVM.

Sarmento L. and Oliveira E. [34] have developed an opinion mining prototype system (OPTIMISM) for the detection and classification of opinions about relevant political actors, regarding a particular topic of debate. Their system gathers opinion-rich texts from Portuguese SM, which are then classified according to their semantic orientation and intensity.

Ramteke J. et al. [35] have provided a two-stage framework to create training data from the mined of two candidates namely Donald Trump and Hillary Clinton. The first stage was based on manual labeling using hashtag clustering and the second stage using Dictionary and sEntiment Reasonerto Valence Aware for the remaining tweets. This two-stage framework has been used to train a supervised Machine Learning (ML) model to perform public sentiment analysis and predict the election outcome.

Sharma P. and Teng-Sheng M. [36] have used the Twitter Archiver tool to get tweets in Hindi language to perform Data Mining on 42,235 tweets collected during the campaigning period for general state elections in 2016. The authors have used Dictionary Based, Naive Bayes, and SVM algorithm to build the classifier, classified the test data as positive, negative and neutral, and then identified the sentiment of Twitter users towards each of the considered Indian political parties. The results show that SVM has higher accuracy than the others algorithms.

Dubey G. et al. [37] apply Text Mining on tweets generated on Twitter sites for two famous Indian political diplomats. The results reveal the value of this competitive study and how these diplomats could deal with their political affairs in a better way and identify areas where they need to take a better step into.

Different technics of Data Mining are used on politics such as SVM, Data Mining, and ML. The studies have shown that SVM outperforms others methods and provides higher accuracy. In the next part, the use of Social Network Analysis on politics will be discussed.

B. Social Network Analysis

Social Network Analysis (SNA) is a technique to represent networks of people by the mean of graphs to explore the relationships between them. This representation is based on illustrating people as nodes and the connection between them as edges.

On politics, social network was used for different purposes such as getting out the vote, reinforce their credibility, influence citizens and identify influencers.

For example, Baumann et al. [38] have examined the Twitter social graph of German politicians and political parties during a period time by constructing two graphs. The first concerns the follower graph and the second related to the mentions graph. And by using several statistics and graph metrics, the results retrieve three distinct groups of political parties.

Rahim, N.A.A. & Sulaiman S. [39] had used centrality measures (betweenness, closeness, degree, and eigenvector) for the political blogosphere dataset to visualize the actors in a network and indicate which nodes provide better performance for each centrality measure. On the other hand, Sinclair, P.A. [40] examines how the node centrality index can be used to index the centralization of political networks of Mexico.

Stamatelatos G. et al. [41] have used the structural features of the Twitter Network of the Greek political scene to reveal valuable information about the political affinity of the participating nodes. The study shows that Twitter followers can be used to predict the political affinity of prominent Nodes of Interest (NOIs) they opt to follow.

Dubois E. and Gaffeny G. [42] have used different centrality metrics to identify influential players in two Canadians political Twitter communities. The findings show that centrality measures revealed top traditional elites (politicians, journalists, and media outlets), while content analysis provides different groups of influencers that include commentators and bloggers. Soares F. B. et al. [43] have used a combination of SNA and qualitative approaches to retrieve influencer's roles in political conversation during the impeachment of the ex-president of Brazil (mention the year). The result shows three types of influencers "Opinion leaders", "Informational influencers", and "activists".

Acharoui Z. et al. [44] have used centrality measured to identify influencers of the political conversation, on YouTube, during the period of the Moroccan election campaign of 2016, and discuss the nature of information shared by those influencers and their profile. The finding shows that digital media and vloggers tend to be centered instead of politician elites and official media who were absent from the top influencer list.

Park, H. W., & Lim, Y. S [45] have examined North Korean propaganda on YouTube using an integrated perspective encompassing the moralist and neutralist approaches. From the moralist approach, a message analysis based on qualitative tagging identified the meaning structure of propaganda embedded in videos on North Korea's YouTube channel. From the neutralist approach, a social network analysis sought to understand the communication structure of the channel. The study observed a sparsely connected social network among ordinary commenters. However, the operator did not exercise tight control over peer-to-peer communication but merely answered questions and tried to facilitate mass participation.

Castro R. [46] Propose a framework that applies SNA techniques and unsupervised ML to infer the political alignment at the state level during Venezuelan Parliamentary election. The study analyzed 60K tweets posted within the Venezuelan geographic boundaries one week before the election day. By applying the framework, the study demonstrates that the online political atmosphere reflects the offline tendency at the state scale.

Kokil J. et al. [47] introduce and evaluate the robustness of different volumetric, sentiment, and SN approaches to predict the elections in three Asian countries - Malaysia, India, and Pakistan from Twitter posts. The finding shows that SN information is stable despite sudden surges in political discussions and methods combining sentiment and volume information, or sentiment and SN information, are effective at predicting smaller vote shares. For example, vote shares in the case of independent candidates and regional parties.

Olanrewaju A. S. T. and Rahayu A [48] have studied the use of social media on how it influenced the Nigeria 2015 elections. SNA was used on the network structure generated during the election. As complimentary analysis, content analysis was performed on tweets submitted during the election process. The findings demonstrate how social media is used as an avenue for encouraging people to vote, collation, and preservation of the election results, which prevents election manipulation that usually happens in Nigeria.

The SNA use in politics is mainly based on analyzing social graph and using centrality measures to visualize SN actors, identify influencers and

IV. CONCLUSION

This paper aims to offer an overview of how social media data is being used for political purposes, as well as the main methods used to achieve politicians' intentions. Overall, our assessment shows that Data Mining and SNA are mainly used by scholars either to predict election results, identify influencers on a social sphere, or to identify SM users' sentiment.

REFERENCES

1. Chen X. et al., "A study on the convergence and analysis of public opinion in cross-linguistic network on Mongolian and Chinese", In International Congress of Information and Communication Technology 2017, Procedia of computer. vol. 107,2017, pp. 768-771.
2. Schwarz A. et al., "The Handbook of International Crisis Communication Research," 1st ed. Wiley Blackwell, 2016.
3. Dong T. et al., "Social media and internet public events," in Telematics and Informatics. Vol. 34, no. 3, 2017, pp. 726-739.
4. Bruhn M. et al., "Are social media replacing traditional media in terms of brand equity creation," Management Research Review, Vol. 35, no. 9, 2012, pp. 770 – 790, http://dx.doi.org/10.1108/01409171211255948
5. Kim Y. A. & Srivastava J., "Impact of Social Influence in E-Commerce Decision Making,", in Proc. of the ninth int. Conference on Electronic Commerce (ICEC'07), 2007, pp. 293-302, doi:10.1145/1282100.1282157
6. Young S. D. et al., "Using social media as a tool to predict syphilis", https://doi.org/10.1016/j.ypmed.2017.12.016
7. Singh P, et al., "Can Tweets Predict Election Results? Insights from Twitter Analytics," in Communications in Computer and Information Science Advanced Informatics for Computing Research, pp. 271–281, 2019.
8. Singh P. and Sawhney R. S., "Influence of Twitter on Prediction of Election Results," in Advances in Intelligent Systems and Computing Progress in Advanced Computing and Intelligent Engineering, 2017, pp. 665–673.
9. Hooghe M. , "Citizenship and Participation," in Comparing Democracies: Elections and Voting in a Changing World, 2014, pp. 58–75.
10. Ekman J. and Amnå E., "Political participation and civic engagement: Towards a new typology," in Human Affairs, vol. 22, no. 3, 2012.
11. Holt K.et al., "Age and the Effects of News Media Attention and Social Media Use on Political Interest and Participation: Do Social Media Function as Leveller?," in European Journal of Communication, vol. 28, no. 1, 2013, pp. 19–34., doi:10.1177/0267323112465369.
12. Effing R. et al., "Social media and political participation: are Facebook,Twitter and YouTube democratizing our political systems? ," in Electron Particip, 2011, pp. 25- 35.
13. Hong S. and Nadler D., "Which candidates do the public discuss online in an election campaign?: The use of social media by 2012 presidential candidates and its impact on candidate salience," in Government Information Quarterly, vol. 29, no. 4, 2012, pp. 455–461. doi: 10.1016/j.giq.2012.06.004
14. Boulianne S. , "Social Media Use and Participation: a Meta-Analysis of Current Research," in Information, Communication & Society, vol. 18, no. 5, 2015, pp. 524–538., doi:10.1080/1369118x.2015.1008542.
15. Paul S. N. Lee et al., "Social Media and Umbrella Movement: Insurgent Public Sphere in Formation," in Chinese Journal of Communication, vol. 8, no. 4, 2015, pp. 356–375., doi:10.1080/17544750.2015.1088874.
16. Wolfsfeld G. et al., "Social Media and the Arab Spring," in The International Journal of Press/Politics, vol. 18, no. 2, 2013, pp. 115–137. doi: 10.1177/1940161212471716
17. Ahmed S. et al., "The 2014 Indian Elections on Twitter: A comparison of campaign strategies of political parties," in Telematics and Informatics, 2016, doi: http://dx.doi.org/10.1016/j.tele.2016.03.002
18. Lee C., et al., "Does Social Media Use Really Make People Politically Polarized? Direct and Indirect Effects of Social Media Use on Political Polarization in South Korea," in Telematics and Informatics, vol. 35, no. 1, 2018, pp. 245–254., doi:10.1016/j.tele.2017.11.005.
19. Bui T.H., "The Influence of Social Media in Vietnams Elite Politics,". In Journal of Current Southeast Asian Affairs, vol. 35, no. 2,2016, pp. 89–111. doi: 10.1177/186810341603500204
20. Karlsen r and Bernard E., "Styles of Social Media Campaigning and Influence in a Hybrid Political Communication System," in The International Journal of Press/Politics, vol. 21, no. 3, 2016, pp. 338–357., doi:10.1177/1940161216645335.
21. Larsson A.O. and Bente K., " 'Of Course We Are on Facebook': Use and Non-Use of Social Media among Swedish and Norwegian Politicians," in European Journal of Communication, vol. 29, no. 6, 2014, pp. 653–667., doi:10.1177/0267323114531383.
22. Stier S.et al., "Election Campaigning on Social Media: Politicians, Audiences, and the Mediation of Political Communication on Facebook and Twitter," in Political Communication, vol. 35, no. 1, 2018, pp. 50–74., doi:10.1080/10584609.2017.1334728.
23. Pal J. and Gonawela A., "Studying political communication on Twitter: the case for small data," in Current Opinion in Behavioral Sciences, vol. 18, 2017, pp. 97–102.
24. Hatzivassiloglou V. and McKeown K. , "Predicting the Semantic Orientation of Adjectives,". In Proceedings of the 35th Annual Meeting of the Association for Computational Linguistics (ACL-97), Madrid, Spain , 1997.
25. Moghaddam S. and Martin E., "Opinion mining in online reviews: Recent trends". in Tutorial at WWW2013, 2013.
26. Tang D. et al., "Building large-scale twitter-specific sentiment lexicon: A representation learning approach". In Proceedings of coling 2014, the 25th international conference on computational linguistics: Technical papers, 2014, pp. 172-182.
27. Skoric M. et al., "Tweets and Votes: A Study of the 2011 Singapore General Election," in 2012 45th Hawaii International Conference on System Sciences, 2012, doi:10.1109/hicss.2012.607.
28. Song M. and C. K. Meen, "RT^2M: Real-Time Twitter Trend Mining System," in 2013 International Conference on Social Intelligence and Technology, 2013, doi:10.1109/society.2013.19.

29. Yang C. et al., "Emotion Classification Using Web Blog Corpora," in IEEE/WIC/ACM International Conference on Web Intelligence (WI07), 2007, doi:10.1109/wi.2007.51
30. Davidov D. et al., Enhanced sentiment learning using twitter hashtags and smileys. In Coling 2010: Posters, 2010, pp. 241-249.
31. Gull R. et al., "Pre Processing of Twitters Data for Opinion Mining in Political Context," in Procedia Computer Science, vol. 96, 2016, pp. 1560–1570., doi:10.1016/j.procs.2016.08.203.
32. Anjaria M. and Guddeti R. M. R., "Influence factor based opinion mining of Twitter data using supervised learning," in 2014 Sixth International Conference on Communication Systems and Networks (COMSNETS), 2014.
33. Mahmood T. et al., "Mining Twitter Big Data to Predict 2013 Pakistan Election Winner," In mic, 2013, doi:10.1109/inmic.2013.6731323.
34. Sarmento L. and E. C. Oliveira, "The Design of OPTIMISM, an Opinion Mining System for Portuguese Politics," In Portuguese Conference on Artificial Inteligence EPIA 2009, 2009, http://www.scientificcommons.org/51946156
35. Ramtek J. et al., "Election Result Prediction Using Twitter Sentiment Analysis," in 2016 International Conference on Inventive Computation Technologies (ICICT), 2016, doi:10.1109/inventive.2016.7823280.
36. Sharma P. and M. Teng-Sheng, "Prediction of Indian Election Using Sentiment Analysis on Hindi Twitter," in 2016 IEEE International Conference on Big Data (Big Data), 2016, doi:10.1109/bigdata.2016.7840818.
37. Dubey G. et al., "Social Media Opinion Analysis for Indian Political Diplomats," in 2017 7th International Conference on Cloud Computing, Data Science & Engineering - Confluence, 2017, doi:10.1109/confluence.2017.7943238.
38. Baumann A. et al., "Twitter and the Political Landscape – A Graph Analysis of German Politicians,",2016
39. Rahim, N.A.A. & Sulaiman, S. (2015). Social network analysis for political blogosphere dataset. 7. 28-44.
40. Sinclair P. A., The political networks of Mexico and measuring centralization, Procedia - Social and Behavioral Sciences, Volume 10, 2011, Pages 26-35, ISSN 1877-0428, https://doi.org/10.1016/j.sbspro.2011.01.005.
41. Stamatelatos, G. et al. "Revealing the Political Affinity of Online Entities through Their Twitter Followers." Information Processing & Management, vol. 57, no. 2, 2020, p. 102172., doi:10.1016/j.ipm.2019.102172.
42. Dubois, E. and Devin G. (2014) "The Multiple Facets of Influence." American Behavioral Scientist 58 (10): 1260–1277, doi:10.1177/0002764214527088
43. Soares, F. B., et al.(2018) "Influencers in Polarized Political Networks on Twitter." Proceedings of the 9th International Conference on Social Media and Society - SMSociety 18,doi:10.1145/3217804.3217909.
44. Acharoui, Z. et al. "Identifying Political Influencers on YouTube during the 2016 Moroccan General Election." Procedia Computer Science, vol. 170, 2020, pp. 1102–1109., doi:10.1016/j.procs.2020.03.061.
45. Park, H. W., & Lim, Y. S. (2020). Do North Korean Social Media Show Signs of Change?: An Examination of a YouTube Channel Using Qualitative Tagging and Social Network Analysis. Journal of Contemporary Eastern Asia, 19(1), 123–143. https://doi.org/10.17477/JCEA.2020.19.1.123
46. Castro, R. et al. "Back to #6D: Predicting Venezuelan States Political Election Results through Twitter." 2017 Fourth International Conference on EDemocracy & EGovernment (ICEDEG), 2017, doi:10.1109/icedeg.2017.7962525
47. Kokil J. et al. (2018): Predicting elections from social media: a three-country, three-method
48. Olanrewaju A. S. T. and Rahayu A., 2017. The Role of Social Media During the 2015 Voting Process in the Nigeria Election. Research Journal of Applied Sciences, 12: 281-287.

AUTHORS PROFILE

Zakia Acharoui, currently a Ph.D. at the Faculty of Sciences, Kenitra, Ibn Tofail University, Morocco. Her main research interests cover the study of data science, Machine Learning, Data Mining.

Badia Ettaki, is a professor at the Engineering School of Information Sciences in Rabat, Morocco. She obtained a doctoral degree in the Statistic Physic. His research interests cover the study of Content and Knowledge Engineering, Machine Learning algorithms and Big Data analytics.

Jamal Zerouaoui, is a professor at the Faculty of Sciences, Kenitra, Ibn Tofail University, Morocco. He received a doctoral degree in the physic science. Currently, his research interests cover modeling using Machine Learning methods in the frame of the physic area.