Predicting the Dark Triad for Social Network Users using Their Personality Characteristics

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Abstract

Every day, social media platforms generate huge amounts of content including posts, images, and social network activities. This motivated scientists to automate users' personalities assessment by analyzing textual, visual, or statistical features. The Dark Triad personality traits, Machiavellianism, Narcissism and Psychopathy, have been proven to be positively correlated with posting and editing selfies on social networks. None of the existing studies examined psychological personality characteristics concealed in the user's generated text as predicting factors for the Dark Triad traits. This paper proposes a prediction method for those negative traits by analyzing personality characteristics identified as the personal Values and Needs, which can be extracted from users' generated text on the social media. The proposed features are employed, single and combined, with various machine learning techniques for predicting the Triad classes. For adjusting trait binary classification, two marginal thresholds are tested: median-based split and reference-based split. The experimental study has shown that regression models using the proposed personality characteristics of Values and Needs features can classify the Dark Triad traits with an accuracy up to 70%, surpassing existing related work that employs traditional textual features. Moreover, the proposed features contributed to much lower-dimensional feature space with 92% savings, additionally, proving better processing for prediction of the traits. Both the median-based and reference-based classification thresholds succeed in providing a discrete classifier with preference for the former.

Key Words: Dark triad, personality traits, personality characteristics, text analysis, prediction.

1 Introduction

Nowadays, there is a recognized popularity of social media usage, resulting in huge amounts of digital content. One of the reasons for such popularity lies in how social media platforms allow people to interact, build a social community and talk freely in different topics without being judged. Recently, there has been a great interest from both business and psychology in studying how users' personality can be identified or analyzed through their digital footprints.

Human personality is understood as a multitude of continuous spectrum of traits. Some of these traits are known to be desirable qualities, such as the "Big Five" traits [6] with five-dimensional factors: Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Positive big five traits with their complements have been analyzed for assessing human personalities on a wide scale [22]. Other traits are malevolent qualities. The "Dark Triad" [17] is such an example including the three-dimensional traits [16]: (i) Machiavellianism – self-interest, cynicism and a tendency to manipulate and exploit others; (ii) Narcissism – grandiose and inflated self-views, sense of entitlement and a craving for admiration; and (iii) Psychopathy – enduring antisocial behavior, impulsivity. Despite being negative traits, the Dark Triad has been identified as related to the complements of some of the positive traits, and hence they lie as intersecting between the big five model and personality disorders [18].

Recent studies focused on predicting Dark Triad, where personality traits are known to be distinctive and taking the form of an enduring pattern. Users with such traits tend to have hostile "anti-social" behavior acting as a source of threat for the surrounding environment. These dark traits are overlapping by sharing some characteristics such as lack of empathy, hostility, interpersonal offensiveness, disagreeableness, and low honesty [10, 4]. Researchers studied the usage of different feature extracted from social media for the assessment of these personality characteristics. On one side, many psychology researchers examined and proved the presence of linkage between different psychological personality characteristics and the Dark Triad. While on the other side, most of the studies focused on using statistical linguistic features but none of them examined these characteristics as predicting factors for the Dark Triad traits.

Personal values and human needs are known to be very important psychological characteristics, which can serve as predictors for many personality traits [14]. Values are known to be motivational variables that define a person's motivations that may be reflected in his behavior. Unlike values, needs are person's desires in life and define variables essential for his well-being.

In this paper, the Needs and Values psychological

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characteristics are studied as features extracted from social posts for the prediction of the Dark Triad classes, Machiavellianism, Narcissism and Psychopathy. For proving the proposed features' relevance, they are also compared versus classical textual features adopted in literature [16]. Different machine learning techniques are subsequently trained using a single or a combination of the proposed features. Furthermore, two thresholding strategies are proposed for providing binary classification, an issue that has been ill-defined in most of the related scientific works. The proposed strategies are based on a median-based split and reference-based split.

The rest of this paper is organized as follows: In Section 2, the related works to personality and Dark Triad prediction are reviewed. The proposed method for the Dark Triad prediction, using the personal Values and Needs category sets, is explained in Section 3. Experiments and results are presented in Section 4, with discussion in Section 5, and finally Section 6 concludes the paper.

2 Related Works

Status updates on social networks are generally analyzed for the Triad prediction as these texts are the most common way used by users to present themselves with their own words. Most of the studies for predicting the dark traits from social networks data apply text analysis and extract textual features, such as words count, part of speech (POS) tags and N-grams [2]. These features are far away from representing the social human activities. Notably, some studies were limited to the prediction of a single trait rather than the whole Triad. On the positive side, some studies succeeded to use the Dark Triad prediction for diverse applications like cyberbullying detection [3], and recruitment decisions [13].

Linguistic Inquiry and Word Count (LIWC)[15] is a linguistic analysis tool that extracts 85 linguistic features, with the four board categories: basic language (e.g., words count), personal concerns (e.g., home), relativity-related (e.g., space), and psychological processes (e.g., positive and negative emotions) categories. The two studies [16, 2] investigated the usage of LIWC features to infer the Dark Triad from data on social media. In [2] , the two predicting regression models Ordinary Least Squares and LASSO were trained. Results indicated strong relationships for the attributes excitable, dutiful, and bold, and weak relationships for cautious, colorful, and leisurely. In addition to textual features, [16] used visual and statistical features with a Linear regression with Elastic Net regularizer was built for classification. The classifier obtained nearly similar performance results across all three traits with a score of R = 0.25 using Pearson correlation. The LIWC features carried a high level of negativity for Psychopathy. However, no LIWC feature was found to be correlated with the Narcissism and Machiavellianism traits.

A deep neural network has been implemented for the single trait psychopath prediction using the user's text on Twitter [1]. A bi-directional Long Short-Term Memory has been used. Results indicated that the proposed model improved the Area Under Curve (AUC) to be 0.82 compared to a benchmark work [21] that uses a Support Vector Machine classifier, and which has a value of AUC equals 0.736.

The literature reports several studies conducted for examining the relationship between personal Values, Needs and the Dark Triad. In regard for the Values for example, positive associations were found between the Triad and self-enhancement, with negative associations for the Triad and self-transcending and conservation in [9, 8]. Similarly, the relationships between the Triad and human Needs revealed existing correlations with the degree of satisfaction and dissatisfactions for the three basic psychological needs: autonomy, competence, and relatedness [11, 7]. Results also showed that the Dark Triad is negatively correlated with the satisfaction of relatedness, while positively correlated with the dissatisfaction of relatedness, competence, and autonomy.

Surveying current researches, it has been shown that most of the works focused on using statistical linguistic features rather than utilizing the personality characteristics concealed in the user's generated text for the Dark Triad traits' prediction. It is expected that examining such novel features will contribute to enhancing the prediction accuracy of traits prediction. Moreover, the utilization of regression models is more addressed rather than other discrete classification models, even though the results of classification models can be as thorough as regression models, besides being understandable, and interpretable for both psychologists and non-psychologists.

3 Proposed Dark Triad Prediction

The proposed prediction method in this work for the Dark Triad is shown in the architecture given in Figure 1. The figure shows 3 modules executed sequentially. First, users' posts are collected by the Data Collection module, which are entered into

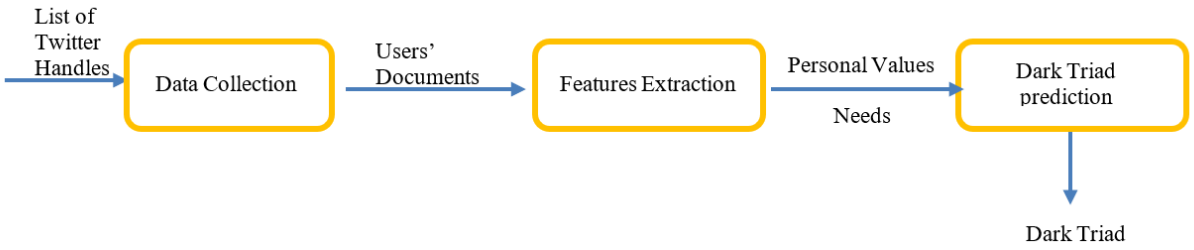

Figure 1: Architecture for the proposed Dark Triad prediction model

the Features Extraction module. In this latter module, the personal Values and Needs features are extracted and concatenated in the form of feature vectors. Vectors are finally inputted for training in the Dark Triad Prediction module. Modules are explained in detail below.

3.1 Data Collection

In the data collection module, Twitter handles (i.e., users' IDs) are used by a Twitter API for the purpose of crawling users' posted tweets. All extracted tweets for each user are then concatenated in a single document.

3.2 Features Extraction

The IBM Watson's Personality Insights is an API service which applies linguistic analysis to infer individual's personality from digital communications. This service embeds different models for personality characteristics inference like "Big Five", personal Values and Needs. The service has been used to extract the user personal Values and Needs features. The extracted Values features are based on Schwartz's personal values theory [19]. Table 1 shows 5 Schwartz Value items with their descriptions. Table 2 describes the 12 Need items as derived from Maslow's hierarchy of needs [12], with their related descriptions.

The 17 output features are organized into 3 category sets as single and combined as presented in Table 3. It is targeted to test those category sets against their discriminative power to categorize the Dark Triad.

3.3 Dark Triad Prediction

The Dark Triad prediction module applies several supervised machine learning techniques using a standard labeled dataset. Linear Regression with elastic net regularizer [23], Normal Linear Regression, Logistic Regression (LR) and Random Forest (RF) are used for prediction to evaluate the proposed category features sets. These models are particularly selected due to their popularity for the Dark Triad prediction.

Most of the datasets and Triad related works were interested in having a score for the Triad classes without having a class label. Our proposed method offers generating a class label. Therefore, for adjusting a binary classification problem, the

Table 1: Schwartz's personal values

(A)	Personal Values	Description
a.1	Self-transcendence	Overcome the limits of self and show concern for the interests of others.
a.2	Conservation	Emphasize resistance to change and self-restriction.
a.3	Hedonism	Seek pleasure and sensual enjoyment.
a.4	Self-enhancement	Seek personal success.
a.5	Openness to change	Emphasize independent action, and willingness for new experiences.

Table 2: Maslow's Needs

(B)	Needs	Description
b.1	Excitement	Feel enthusiasm and eagerness.
b.2	Harmony	Appreciate other people, viewpoints, and feelings.
b.3	Curiosity	Have a desire to discover.
b.4	Ideal	Desire perfection.
b.5	Closeness	Relish being connected to family and setting up a home.
b.6	Self-expression	Enjoy discovering and asserting own identity.
b.7	Liberty	Behave or change with no constraints.
b.8	Love	Enjoy social contact.
b.9	Practicality	Tend to achieve clearly useful objective.
b.10	Stability	Seek equivalence in the physical world.
b.11	Challenge	Desire to take and achieve tasks.
b.12	Structure	Desire to hold things together and ensure well organized and under control tasks.

Table 3: Category sets of proposed features

	Proposed Features	Number of Features
Set I	Personal Values	5
Set II	Needs	12
Set III	Personal Values + Needs	17

class label is divided into two segments (High and Low), for each dark trait. Two thresholding strategies were adopted for the marginal alignment. The first strategy sets the threshold margin between the two segments based on the median value of the continuous output class value. This has been used in [20]. The second strategy adopts referenced values in the previously conducted psychological study in [5].

4 Experiments and Results

4.1 Dark Triad Dataset and Development Environment

A labeled dataset from Twitter for 863 users is used, which was originally built and used in [16]. In this dataset, participants were asked to provide their Twitter handles in addition to filling the 'Dirty Dozen' 5 scale questionnaires resulting in a validated log-scaled continuous values ranging from 0 to 1.609 for each dark trait. Contrarily to the proposed work that uses personal Values and Needs features, the work in [16] used 224 features from the same dataset, including analyzed text features (unigrams, word frequencies, word clusters) sentiments, user demographics, platform usage, and profile images features for the prediction of the Dark Triad.

To prepare our dataset, Twitter handles for the aforementioned 863 users are entered into Data Collection Module to crawl the tweets of all users. The result from this crawling step was 564 public and valid Twitter IDs out of 863. The demographics was 37% Males and 63% Females. The final dataset has been divided into a (70%) training set and a (30%) testing set. Experiments were conducted on a computer with Intel core i7 processor, 16 GB RAM and Windows 10 OS.

4.2 Evaluation Metrics

Two metrics are used for evaluating the performance of the proposed Dark Triad prediction method. They are Accuracy and Root Mean Square Error (RMSE). The latter is for regression techniques only. Prediction is made as a binary classification in two segments identified as "Highly affected" and "Slightly affected". Accuracy measures the model's ability to differentiate correctly between the "Highly affected", and "Slightly affected" segments' users, and is defined by:

$$Accuracy = \frac{Number\ of\ Correct\ Predictions}{Total\ Number\ of\ Predictions} \quad (1)$$

RMSE is a measure for the fitness of the linear regression model, and is defined as:

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}(P_i - O_i)^2}{n}} \quad (2)$$

The numerator is the residuals' variance, with the residual being the difference between the observed value O and the predicted value P, and for n representing the number of samples (564 for our case).

4.3 Experimental Results

Two sets of experiments were implemented to compare the machine learning techniques: binary discrete classifiers versus regression classifiers. For discrete classifiers, LR and RF are used, while for regression, Normal Linear Regression and Linear regression with Elastic Net regularizer are used. The regression prediction in [16] was also implemented on the same computer for comparison purposes.

For tuning the prediction models, the two thresholding strategies for the identification of the classification border are tested. They are identified as follows:

- Threshold θ1: the median value for the traits' scores represents the boundary threshold value. Assuming the dataset to cover almost all population variance, we hypothesized that the high segment contained users scoring greater than or equal the median value for a dark trait "Highly affected", with the low segment contained users scoring less than the median "Slightly affected". For the experimented dataset, a boundary is identified for the three classes as a single common value as in [20]. Our dataset boundary value is 0.8045.
- Threshold θ2: the discriminative values proposed in [5] are used. These threshold values are scaled to fit to log-based class valued in our test dataset. The three different marginal values to indicate whether a user is "Highly affected" or "Slightly affected" are (0.315, 0.5, and 0.35) for Machiavellianism, Narcissism and Psychopathy respectively. In each experiment, the classifiers' performance measures have been recorded against the proposed feature category sets in Table 3, and for the different thresholding strategy adopted.

Table 4 summarizes the Accuracy values for the LR and RF classifiers for each trait of the Dark Triad, using different feature category sets and at the two different thresholds. The table shows that LR classifier achieves better accuracy than RF, and that threshold θ1 is relatively better than θ2. With the threshold θ1, LR has an average classification accuracy of 69.9% while using the proposed features' sets. On the trait

Table 4: Accuracy of predicting the Dark Triad using different classification techniques and features set at different classification thresholds

Classification Threshold	Classifiers	Features	TRAITS' classification Accuracy (%)			Avg. Trait Accuracy (%)	Avg. Classifier Accuracy (%)
			Machiavellianism	Narcissism	Psychopathy		
(θ1)	LR	Set (I)	73.4	61.0	75.0	**69.8**	**69.9**
		Set (II)	72.2	61.5	75.0	**69.6**	
		Set (III)	73.8	61.5	75.7	**70.3**	
	RF	Set (I)	64.5	52.1	78.1	**64.9**	**66.8**
		Set (II)	69.2	58.6	78.7	**68.8**	
		Set (III)	65.7	54.4	79.9	**66.7**	
(θ2)	LR	Set (I)	69.8	69.2	62.7	**67.3**	**66.6**
		Set (II)	69.0	66.9	63.3	**66.4**	
		Set (III)	69.2	68.6	60.9	**66.3**	
	RF	Set (I)	65.0	63.9	51.5	**60.1**	**62.4**
		Set (II)	68.6	62.7	59.7	**63.7**	
		Set (III)	67.5	62.7	59.8	**63.3**	

level, set (III) achieved the best accuracy 70.3% proving to be the best predictor category set for all the traits; Machiavellianism (73.8%), Narcissism (61.5%) and Psychopathy (75.7%). Again, LR was better than RF with an average accuracy of 66.6% when using threshold θ2. At the reference-based threshold, however, the category set (I) – personal Values - has the highest accuracy for the Dark Triad prediction with the average accuracy 67.3%. The features were found to be best predictors for Machiavellianism and Narcissism traits. It is noted that using θ2 has better Narcissism classification than θ1 with an increase of 7.7%. This aligns with findings in [5] stating such high predicting power for this trait using this trait reference-based threshold.

The second experiment set tests the techniques: Normal Linear Regression and Linear Regression with an Elastic Net regularizer. Linear Regression with an Elastic Net regularizer technique was trained using different tuning parameter $\alpha \in [0,1]$, representing the degree of mixing between two regularized regressions: ridge $(\alpha = 0)$ *and Lasso* $(\alpha = 1)$ regression models, to find the value resulting in the smallest error.

Table 5 shows the RMSE values for regression techniques, for the three feature category sets and for the two thresholds. The α column data represents the value that generated the smallest RMSE. The results in Table 5 show that the Linear Regression with an Elastic Net regularizer generated better prediction for all the feature sets; with an average of RMSE 0.395, comparing to Normal linear regression model with RMSE 0.409. Again, the Values features proved to be the best predictor for all traits with an average RMSE 0.388.

Applying the classification thresholding strategies to classify the testing set into "Highly affected", and "Slightly, the accuracy values of regression techniques' classification are computed and stated in Table 6. The table shows the Linear Regression with an Elastic Net regularizer is better than the Normal Linear Regression for the two thresholds. Threshold θ1 is relatively better than θ2 for both the trait and average accuracies. Like the RMSE, at θ1, Set (III) generated the best prediction with an average accuracy of 69%. At θ2, the results show still that feature set (III) -combined Values and Needs – is the best for trait and average accuracies. The average accuracy in this case is 68.3%.

Comparing the results of both classification thresholds on each trait level, the Narcissism prediction shows improvement by 13.4% when using the reference-based threshold (θ2), which again aligns with the findings in [5], stating the high predicting power for this trait at this threshold.

5 Discussion

The results presented showed that the regression models in general can provide an average accuracy of about 70% for predicting the Dark Triad. The median-based threshold provides a better classification split for the High and Low segments that the referenced based threshold in [20]. It is noted however that the referenced-based threshold is very effective for the boundary split of the Narcissism trait. Regarding the different feature category sets, the combined set of Values and needs were the most efficient set. The Values set alone also appears to be slightly efficient than the Needs set.

When comparing the results of the proposed features in this work with other features, such as those in [16], the favor comes to the proposed feature sets. Figure 2 shows the Dark Triad accuracy values for the regression models that performed the best in the experiments (LR and Linear regression with an Elastic Net regularizer) compared to related work.

The figure proves that results for the proposed method using the Values (Set (I) and Values-Needs combined (Set (III)) surpass that of related work, in terms of predicting accuracy for the Triad. The Linear regression with an Elastic Net

Table 5: RMSE for predicting the Dark Triad using different regression techniques and features sets

		Machiavellianism		Narcissism		Psychopathy			
Classifiers	Features	RMSE	α	RMSE	α	RMSE	α	Avg. RMSE per Trait	Avg. RMSE per classifier
Normal Linear Regression	Set (I)	0.382	-	0.431	-	0.375	-	**0.396**	**0.409**
	Set (II)	0.386	-	0.438	-	0.378	-	**0.401**	
	Set (III)	0.438	-	0.432	-	0.427	-	**0.432**	
Linear Reg. with elastic net regularizer	Set (I)	0.376	1	0.414	0	0.372	1	**0.388**	**0.395**
	Set (II)	0.376	1	0.415	0	0.375	1	**0.389**	
	Set (III)	0.424	0	0.422	0	0.385	1	**0.409**	

Table 6: Accuracy of predicting the Dark Triad using different regression techniques and features sets at different classification thresholds

Classification Thresholds	Classifiers	Features	TRAITS' classification Accuracy (%)			Avg. Trait Accuracy (%)	Avg. Classifier Accuracy (%)
			Machiavellianism	Narcissism	Psychopathy		
(θ1)	Normal Linear Regression	Set (I)	69.0	57.4	80.1	**68.9**	**67.6**
		Set (II)	68.0	55.3	80.4	**67.9**	
		Set (III)	65.2	56.0	77.0	**66.1**	
	Linear Reg. with elastic net regularizer	Set (I)	70.0	56.7	80.1	**69.0**	**69.0**
		Set (II)	70.0	56.7	80.1	**69.0**	
		Set (III)	70.9	56.7	78.7	**69.0**	
(θ2)	Normal Linear Regression	Set (I)	72.3	67.4	57.4	**65.7**	**65.5**
		Set (II)	72.3	67.4	61.0	**66.9**	
		Set (III)	67.4	63.8	60.0	**63.7**	
	Linear Reg. with elastic net regularizer	Set (I)	72.3	66.7	60.3	**66.4**	**67.1**
		Set (II)	72.3	66.7	60.3	**66.4**	
		Set (III)	68.1	70.1	66.0	**68.3**	

regularizer has the highest accuracies for all the traits. The Logistic Regression also records higher accuracies with precedence for two traits over the related work that uses also a Logistic regression classifier but surpasses with only one trait. Notably, such difference did not have an impact on the overall average accuracy. The classifiers Logistic Regression + Feature Set (III), Linear regression with an Elastic Net regularizer + Feature Set (III), Linear regression with an Elastic Net regularizer + Feature Set (I), and the related work using Logistic Regression have the following traits prediction accuracies (70.3%, 69%, 68.9, 62.9%) respectively.

It is worth mentioning that the proposed method using θ1 contributed to an increase of 7.42% over the related work, and also while using θ2, the proposed method still surpasses the related work by 2.77%. This proves the higher predictive power of the proposed Values and Needs features and their relevance, when compared to other feature variants, such as unigrams, word frequencies, sentiments, user demographics, platform usage, and profile images. Comparing the dimensionality of the features employed in the proposed method to [16], precedence comes for the 17 proposed features versus 224 by related work. The extracted features in the former has the size 68 bytes compared to 866 bytes. This contributes to lower-dimensional feature space with 92% savings. It can be concluded that regression models are

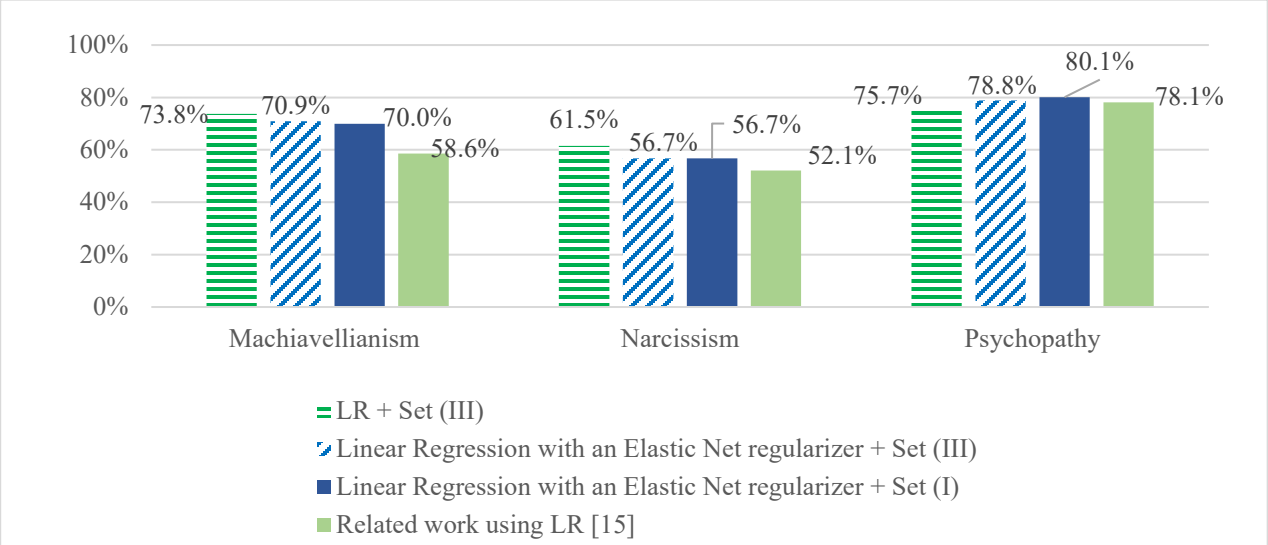

Figure 2: Comparing the dark triad predicting accuracy for the proposed method/features against related work

good predictors for social network users with regard of Dark Triad characteristics. The newly introduced personality characteristics of Values and Needs are relevant. It is also highlighted to emphasize attention to classification thresholds as an important tuning parameter

6 Conclusion

The prediction of the Dark Triad from social media is an important topic that can reveal much about human behavior. In this paper, the Dark Triad is predicted through personal Values and Needs as features extracted from users' generated text on social media. Supervised machine learning such as regression and classification techniques are proposed to classify the three-class Dark Triad. Two classification thresholding strategies are studies for discriminating traits degree for the users. Experiments recorded a classification accuracy in the range of 62-70%. It has been proved that a combined feature set of both Values and Needs features using regression techniques results in the best classification with an accuracy of 70%. In comparison to other existing classical features, the proposed method and features demonstrates efficiency in performance. The proposed method records 7.42% increase in the Triad accuracy and 92% savings in dimensional space.

References

[1] H. Ahmad, A. Arif, A. M. Khattak, A. Habib, M. Z. Asghar, and B. Shah, "Applying Deep Neural Networks for Predicting Dark Triad Personality Trait of Online Users", *International Conference on Information Networking*, Janua, 2020:102-105, 2020, doi: 10.1109/ICOIN48656.2020.9016525.

[2] R. Akhtar, D. Winsborough, U. Ort, A. Johnson, and T. Chamorro-Premuzic, "Detecting the Dark Side of Personality Using Social Media Status Updates", *Personality and Individual Differences*, 132:90-97, May 2018, doi: 10.1016/j.paid.2018.05.026.

[3] V. Balakrishnan, S. Khan, and H. Arabnia, "Improving Cyberbullying Detection using Twitter Users' Psychological Features and Machine Learning", *Computers & Security*, p. 101710, 2019, doi: 10.1016/j.cose.2019.101710.

[4] B. M. Dinić and T. Jevremov, "Trends in Research Related to the Dark Triad: A Bibliometric Analysis", *Current Psychology*, 40(7):3206-3215, 2021, doi: 10.1007/s12144-019-00250-9.

[5] D. Garcia, B. N. Persson, A. Al Nima, J. G. Brulin, M. Rapp-Ricciardi, and P. J. Kajonius, "IRT Analyses of the Swedish Dark Triad Dirty Dozen", *Heliyon*, 4(3):1-14, 2018, doi: 10.1016/j.heliyon.2018.e00569.

[6] O. P. John and S. Srivastava, *The Big-Five Trait Taxonomy: History, Measurement, and Theoretical Prespectives*, University of California, Berkeley, CA, 1999.

[7] P. K. Jonason and J. D. Ferrell, "Looking Under the Hood: The Psychogenic Motivational Foundations of the Dark Triad", *Personality and Individual Differences*, 94:324-331, 2016, doi: 10.1016/j.paid.2016.01.039.

[8] P. K. Jonason, M. A. Koehn, R. A. Bulyk, and M. D. Davis, "Standing Out and Not Fitting in: The Dark Triad Traits and Social Values", *Journal of Social Psychology*, 160(2):164-169, 2020, doi: 10.1080/00224545.2019.1623162.

[9] P. K. Jonason, G. L. Strosser, C. H. Kroll, J. J. Duineveld, and S. A. Baruffi, "Valuing Myself over Others: The Dark Triad Traits and Moral and Social Values", *Personality and Individual Differences*, 81:102-106, 2015, doi: 10.1016/j. paid.2014.10.045.

[10] D. N. Jones and D. L. Paulhus, "The Role of Impulsivity

in the Dark Triad of Personality", *Personality and Individual Differences*, 51(5):679-682, 2011, doi: 10.1016/j.paid.2011. 04.011.
[11] S. B. Kaufman, D. B. Yaden, E. Hyde, and E. Tsukayama, "The Light vs. Dark Triad of Personality: Contrasting Two Very Different Profiles of Human Nature", *Frontiers in Psychology*, 10:1-26, March 2019, doi: 10.3389/fpsyg.2019.00467.
[12] A. H. Maslow, "A Theory of Human Motivation", *Psychological Review*, 50(13):370-396, July 1943.
[13] S. Nuzulia and F. Y. P. Why, "When the Dark Shines: The Role of Dark Personality Traits in Leadership Role Occupancy and Hiring Decisions in a Collectivistic Culture", *Social Psychological and Personality Science*, 11(8):1089-1100, 2020, doi: 10.1177/1948550619893956.
[14] L. Parks-Leduc, G. Feldman, and A. Bardi, "Personality Traits and Personal Values: A Meta-Analysis", *Personality and Social Psychology Review*, 19(1):3-29, 2015, doi: 10.1177/1088868314538548.
[15] J. W. Pennebaker, M. E. Francis, and R. J. Booth, "Linguistic Inquiry and Word Count: LIWC," Mahwah, NJ: Eribaum, pp. 1-24. January 2001.,
[16] D. Preoţiuc-Pietro, J. Carpenter, S. Giorgi, and L. Ungar, "Studying the Dark Triad of Personality Through Twitter Behavior", *Proceedings of International Conference on Information and Knowledge Management*, 24-28:761-770, Oct. 2016, doi: 10.1145/2983323. 2983822.
[17] A. Schreiber and B. Marcus, "Applying Deep Neural Networks for Predicting Dark Triad Personality Trait of Online Users", Psychological Bulletin, pp. 102-105, July 2020, doi: 10.1037/bul0000299.
[18] A. Schreiber and B. Marcus, "The Place of the 'Dark Triad' in General Models of Personality: Some Meta-Analytic Clarification", Psychological Bulletin, pp. 1-78, July 2020, doi: 10.1037/bul0000299.
[19] S. H. Schwartz, "Universals in the Content and Structure of Values: Theoretical Advances and Empirical Tests in 20 Countries", *Advances in Experimental Social Psychology*, 25(C):1-65, 1992, doi: 10.1016/S0065-2601(08)60281-6.
[20] C. Sumner, A. Byers, R. Boochever, and G. J. Park, "Predicting Dark Triad Personality Traits from Twitter Usage and a Linguistic Analysis of Tweets", *Proceedings 11th International Conference on Machine Learning and Applications, ICMLA 2012*, 2:386-393, December 2012, doi: 10.1109/ICMLA.2012.218.
[21] R. Wald, T. M. Khoshgoftaar, A. Napolitano, and C. Sumner, "Using Twitter Content to Predict Psychopathy", *Proceedings - 2012 11th International Conference on Machine Learning and Applications, ICMLA 2012*, 2:394-401, , 2012, doi: 10.1109/ICMLA.2012.228.
[22] Y. Wang, "Understanding Personality through Social Media," Technical Report, Stanford University, 2015.
[23] H. Zou and T. Hastie, "Regularization and Variable Selection via the Elastic Net", *Journal of the Royal Statistical Society. Series B: Statistical Methodology*, 67(2):301-320, 2005, doi: 10.1111/j.1467-9868.2005. 00503.x.

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