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Prediction analysis of the happiness ranking of countries based on macro level factors

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ABSTRACT

Happiness is an essential universal human goal in their life that can improve the quality of life. Since the introduction of positive psychology, the primary consideration has been pointed out to the study of the role from certain factors in predicting the happiness, especially the advancement of technology that allows computer-mediated to be part of human interaction. It provides a multidimensional approach and indirect influence to the human expression and communication. The project investigates what it takes to build a happy country by analysing on the relationship between the happiness ranking of countries and their macro level factors. The World Happiness Report 2019 is used coupled with Python programming for visualizing and extracting information from the dataset to better understand the bigger picture.

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1. INTRODUCTION

In the past decade, several online communities have grown and are important in everyday life. Today, it acts as a platform for the communication and interaction process among communities both in individual life and in the commerce environment. Thus, the number of data used and utilized has been growing significantly both from users and providers. Therefore, this large amount of data is a worthy source of study since allowing the study of people's behaviour and their interactions. Therefore, happiness is subjective depending on who you ask the question to. Some people are satisfied with only little fulfilment of their needs while some might require larger support from others. Recently, there are advanced progress in applying computing technologies [R1-R8] that have significant progress in artificial intelligence [1]-[8]. Meanwhile, personal cognition researchers have turned to the study of social media and digital devices to ask whether a person's digital effects can reveal aspects of their identity. At the same time, advances in big data analysis have shown that computer algorithms can predict the traits of individuals from their digital effects [9]. Everyone has a different source of happiness and degree of fulfilment to achieve that happiness. On a global scale, where countries are involved to represent the people, larger factors come into play that could have rippling effect worldwide on the happiness level experienced. This research has objective to investigate the connection link between happiness and macro level factors namely incomes, life expectancy, social support, generosity, corruption and freedom. Utopia is seen as a country in which everyone is happy. A utopia can be built without having a complete aggregation of promising statistics of all happiness factors. There could be a trade-off elsewhere that could be identified as a non-factor to the construction. Therefore,

the problem of determining the right blend of attributes of happiness is evident, thus examining from a bird's eye view will give a clearer understanding of what it takes to reach a utopian state. In general, people often spend an average of 20% of their time socializing with others through various channels, especially through face-to-face conversations [10].

2. MATERIAL AND METHOD

Aristotle's wisdom explained that more than anything else, men and women seek happiness. Happiness can be defined as a sense of well-being, joy, showing pleasure or contentment. It also can be understood as fortunate and convenient. Commonly found, someone will feel happy when she or he is successful, safe or lucky. Our world community is adamant to foresight the future population to enjoy sustainable happiness. The World Happiness Report [11] has presented the list of global countries based on the happiness index from total of 156 countries. They were ranked based on several indicators that point out on the level of happiness of average citizen for thinking about themselves. This report explained the evolution of happiness that changes over time due to several event or condition. The focus emphasized that the technologies, environment, culture, clash, even the government policies has been believed to be the drivers for changing the world happiness level. In recent years, many countries in the world seeks to build a happy country. For example, New Zealand will spend almost NZ$2 billion for health services which include mental health, fully funded hospital and children well-being. Several European countries such Finland, Norway and Denmark have been pronounced top three (3) happiest country in the world in 2018 and the United Nation, with the sustainable development goal also leading to ensure the world we are living is sustainable and people are happy and have quality of life.

In the view of research, the happiness can be defined as the collaboration of how satisfied person with the condition or the quality of his/her life for such as to find out the true meaning of working hard and the feelings over daily routine in term of interaction with the others. Interestingly, one research affirms that happiness is not sent to external events but in how we interpret them [12]. It is actually a condition that each person must prepare, develop and personally. People who learn to control internal experiences that will determine the quality of their life, which is the closest thing to us to be happy. Therefore, happiness is in inner harmony, while people with inner harmony who led energetic lives are open to diverse experiences, continue to learn until the day of their death, and have strong ties and commitments to others and the environment in which they live. They enjoy what they do, even if it is boring or difficult, which are almost never bored and can calmly accept whatever comes their way.

Many scales and questionnaires have been developed to measure happiness. Happiness can be measured with satisfaction with life scale [13]. In 1988, it have been introduced positive and negative affect schedule (PANAS) Scale with measure happiness which consists of two mood scales, measuring positive and negative influence [14]. When used as a psychometric scale, PANAS can show the relationship between both of the influences with statistics and personality traits. Another scale that directly measure people happiness is subjective happiness scale (known as general happiness scale) [15]. The happiness is measured in scale of 7 from not a very happy to the opposite. Other questions cover comparisons with peers, general people happiness and characterization that describe the subject. In year 2002, Argyle and Hill have produced an advanced instrument or indicators namely the Oxford Happiness Questionnaire (OHQ), which was the modification from the Oxford Happiness Inventory (OHI) [16]. In summary, OHI consist of 29 items that include the four optional selection of the conditions [17]. The OHQ consists of similar items as in OHI, which measured in six-point Likert scale. Currently, there are many challenges have been studied related to predict the happiness specially to adapt to their behavior according to the network behavior such as an assessment to find out the user generated text with the social influence model that describe interdependency between user emotions and sentiments [18]. Meanwhile, the approach is supposed to not only present a high degree of control but also offer external validity in term of exchanging practical information in the process of maintaining social relationships [19].

The distinctive feature of communication channel has been used become the determinant of happiness through various spectrums. Thus, the business transactions involving the electronic commerce and the investment has become the main ingredients for other daily routine in term of online exchange, online games, streaming videos and music. Actually, user often categorizing those activities based on the platform or the supported tools. Therefore, the communication via social media such as Skype, Facebook, Whatsapp or Weechat provides less work value in comparison to other online tasks, which mobile services are decided upon its distinctive feature led to the greater customer happiness [20]. Given the ultimate question on the reason of certain people become happier compare to the others, or others on the motivation of some people have the tendency to be happy even though they are in the negative condition, Actually, what is worth noting is that self-happiness has been seen as a common concept in psychological study and a place of interest to search for. It should be seen as an important part of human life related to human beings' essential goal.

Therefore, self-happiness is a relatively consistent structure over time, which in every condition has an impact on how people feel, think, recall and see certain life events in either negative or positive direction [21], [22]. The relationship between facial expressions and emotions has been extensively studied, leading to primary theories that indicate brief nonverbal cues reveal much about individuals' emotional states, which mostly Ekman's facial action coding system (FACS) has been used widely to characterized and code the smile intensity or level. The dataset used for the project is the World Happiness Report of 2019, which has been produced by software-defined satellite networking (SDSN) and extracted by PromptCloud's custom web crawling solution. It was later found in the Kaggle website which is a public data platform for the data science and machine learning towards community to work together in exploring and building models while engaging in competition to solve challenges. The 2019 World Happiness Report is a landmark survey of the ranking list of global happiness countries by tagging with several macro level factors contributed to the happiness score of several countries. In performing exploratory analysis of the dataset, Kaggle's Python is used since it provides a well-equipped workspace to carry out programming with ease on the dataset.

3. RESULTS AND DISCUSSION

Currently, some studies suggest that in all modes of communication except Skype, participants experience more happiness when there is laughter, both tangible and symbolic, which is determined critically to the interaction conducted rather than the duration it have taken [19]. Actually, the tradition has suggested that happiness is achieved when every domain and subdomain of fulfilment are satisfied, which indicated that personal health in term of leisure and work activities should be greater compare to expectation [23], [24]. The more interaction occurred among human or the greater time provided to have exercise those are strongly linked to happiness [25]. It should take a note that the related factors contributing to combating depression such as self-reported happiness, social support and job participation, which provide the defense mechanism and capability to face in direct way with the negative life events without becoming depressed. Meanwhile, physiological factors also influence susceptibility to depression, and many studies show that a strong association between sleep disturbances, subsequent depression, and physical health is closely related to depression and happiness [26]-[30]. For the purpose of this study, in (1) the exploratory analysis begins by importing the required libraries and defining the functions required to plot the data. The dataset is then read into a variable to be stored for further processing, which can be seen in (2).

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import os                                                    (1)

Data = pd.read_csv('../world-happiness-report-2019.csv')     (2)
```

Predictive models use patterns found in transactional and historical data to identify risks and opportunities. The model captures the relationships between many factors to allow an assessment of the risk or potential associated with a specific set of conditions, guiding decision making for candidate transactions. The general overview of the data based on the columns is described:

- Country (region): Name of the country.
- Ladder: Measure of life satisfaction.
- SD of Ladder: Standard deviation of the ladder.
- Positive affect: Measure of positive emotion.
- Negative affect: Measure of negative emotion.
- Social Support: The extent provided to the accumulation of the happiness score.
- Freedom: The extent provided to the accumulation of the happiness score.
- Corruption: The extent provided the accumulation of the happiness score.
- Generosity: The extent provided to the accumulation of the happiness score.
- Log of gross domestic product (GDP) per capita: The extent provided to the accumulation of the happiness score.
- Healthy life expectancy: The extent provided to the accumulation of the happiness score.

The happiest countries in the world are listed in Table 1 while the opposite are listed in Table 2. On the other hand, renaming certain attribute names is conducted for simplicity as shown in (3) while (4) presented the dimensions of the dataset obtained are 156 rows and 9 columns. Futhermore, in Figure 1,

predictive analysis is carried out to predict at a more detailed level, namely, to produce a prediction score or so-called probability for each element of the organization through (5). This sets it apart from foresight, while, the number of rows missing from the value is obtained.

Table 1. The list of happiest countries

	Country (region)	Ladder	SD of Ladder	(+) affect	(-) affect	Social support	Freedom	Corruption	Generocity	Log of GDP per capita	Healthy life expectancy
0	Finland	1	4	41.0	10.0	2.0	5.0	4.0	47.0	22.0	27.0
1	Denmark	2	13	24.0	26.0	4.0	6.0	3.0	22.0	14.0	23.0
2	Norway	3	8	16.0	29.0	3.0	3.0	8.0	11.0	7.0	12.0
3	Iceland	4	9	3.0	3.0	1.0	7.0	45.0	3.0	15.0	13.0
4	Netherlands	5	1	12.0	25.0	15.0	19.0	12.0	7.0	12.0	18.0
5	Switzerland	6	11	44.0	21.0	13.0	11.0	7.0	16.0	8.0	4.0
6	Sweden	7	18	34.0	8.0	25.0	10.0	6.0	17.0	13.0	17.0
7	New Zealand	8	15	22.0	12.0	5.0	8.0	5.0	8.0	26.0	14.0
8	Canada	9	23	18.0	49.0	20.0	9.0	11.0	14.0	19.0	8.0
9	Austria	10	10	64.0	24.0	31.0	26.0	19.0	25.0	16.0	15.0

Table 2. The list of unhappiest countries

	Country (region)	Ladder	SD of Ladder	(+) affect	(-) affect	Social support	Freedom	Corruption	Generocity	Log of GDP per capita	Healthy life expectancy
146	Haiti	147	111	142.0	119.0	146.0	152.0	48.0	20.0	138.0	125.0
147	Botswana	148	125	87.0	65.0	105.0	60.0	54.0	150.0	66.0	113.0
148	Syria	149	137	155.0	155.0	154.0	153.0	38.0	69.0	NaN	128.0
149	Malawi	150	132	110.0	110.0	150.0	65.0	64.0	109.0	147.0	119.0
150	Yemen	151	85	75.0	75.0	100.0	147.0	83.0	155.0	141.0	124.0
151	Rwanda	152	63	102.0	102.0	144.0	21.0	2.0	90.0	132.0	103.0
152	Tanzania	153	122	50.0	50.0	131.0	78.0	34.0	49.0	125.0	118.0
153	Afghanistan	154	25	133.0	133.0	151.0	155.0	136.0	137.0	134.0	139.0
154	Central African Republic	155	117	153.0	153.0	155.0	133.0	122.0	113.0	152.0	150.0
155	South Sudan	156	140	152.0	152.0	148.0	154.0	61.0	85.0	140.0	143.0

```
data = data.drop([`Ladder`, `SD of Ladder`], axis=1)                    (3)

data = data.rename(columns={`Country (region)`:`Country`,
`Positive affect`:`Pos`, `Negative affect`:`Neg`,
`Log of GDP\nper capita`:`GDP`,
`Healthy life\nexpectancy`:`Life expectancy`})                          (4)

data.shape(156, 9)                                                      (5)
```

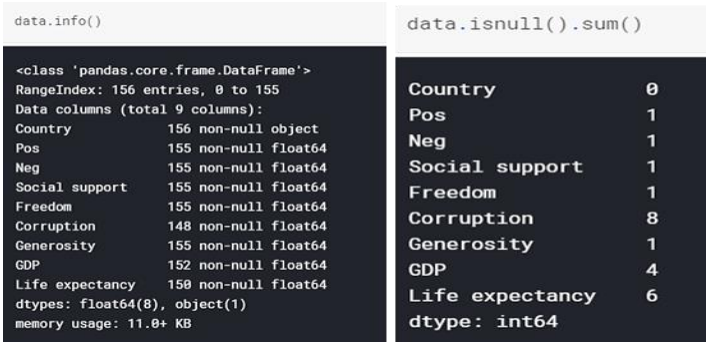

Figure 1. The results from predictive analysis

In the process, there is an indication for a missing value within the dataset and the data needs to be cleaned. Since the data set is rather small, (6) has been used for deleting rows with missing values which is the best option for this case. Now the dataset is clean with all rows complete although the size is reduced by the values in each column. To dissect the dataset further, a numerical description of each attribute is included.

By implementing (7), the information reveals very similar values for each attribute, which signals that a ranking system is used to order the countries, thus making the nature of the dataset filled with ordinal attributes. Before proceeding to the visualization part, (8) has been used to introduce class labels to group countries according to their happiness rating. This divides the dataset into 3 equal size grouping to be made a class label. Thus, the dataset is introduced a new attribute called class which has the 3 class labels; 0 for the top 46 countries in happiness ranking, 1 for the middle 46 countries in happiness ranking, 2 for the bottom 46 countries in happiness ranking. The happiest countries in each grouping are shown in Table 3. Meanwhile, the line graph of each of the main attributes with respect to happiness ratings can be seen in Table 4 through (9) for classifying process.

```
data = data[~data.isnull().any(axis=1)]
data.shape
(140,9)                                                    (6)

data.describe()                                            (7)
```

Table 3. The list of data set for happiness factors

	Pos	Neg	Social support	Freedom	Corruption	Generosity	GDP	Life expectancy
count	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00
mean	78.24	79.15	77.50	78.82	75.70	78.85	79.01	75.47
std	44.33	44.50	45.81	45.10	42.65	44.72	43.35	43.97
min	1.00	2.00	1.00	1.00	1.00	1.00	2.00	1.00
25%	40.75	40.75	36.75	39.75	39.75	40.75	41.75	36.75
50%	78.50	78.50	77.50	79.50	76.50	79.50	78.50	77.50
75%	116.25	117.25	118.25	118.25	112.25	116.25	117.25	113.25
max	154.00	154.00	155.00	155.00	148.00	155.00	152.00	150.00
count	140.00	140.00	140.00	140.00	140.00	140.00	140.00	140.00

```
data[`Class`] = 0
data.iloc[size:2*size][`Class`] = 1
data.iloc[2*size:][`Class`] = 2                            (8)

data.iloc[[0, size, 2*size], :]                            (9)
```

Table 4. The list of happiest countries after classifying process

	Country	Pos	Neg	Social support	Freedom	Corruption	Generosity	GDP	Life expectancy	Class
0	Finland	41.0	10.0	2.0	5.0	4.0	47.0	22.0	27.0	0
53	South Korea	101.0	45.0	91.0	144.0	100.0	40.0	27.0	9.0	1
104	Laos	5.0	112.0	120.0	22.0	27.0	34.0	102.0	112.0	2

The shape of the graphs confirms the results described as can be seen in appendix of mapping attributes with the social support, GDP and life expectancy attributes are having an almost linear line, which can be seen in Figures 2 and 3 in Appendix. Meanwhile, the generosity, freedom and corruption attributes are unable to approach an appropriate straight line. Maps of the world has function to show the exact location where the happiest and unhappiest countries are; plus how the other factors might influencce. For this visualization can be seen in appendix of world map visualization, the darker red a country is, the less happy or satisfied they are. The lighter colour countries are the happier ones. White colour and black colour represent unknown values and missing values respectively as can be seen in Figures 4 and 5 in Appendix. The map shows that the North America continent, European continent, and Australia continent are the happiest while the Asian continent and the South American continent are in the middle with the African continent all the way down when it comes to happiness. This statistic is aligned with the fact that the three major groups can be formed as created based on our previously introduced class labels. At first glance, the groups of continents show similar characteristics. The triad of the North America continent, European continent, and Australia continent contains modern and developed nations. The duo of the Asian continent and the South American continent contains fast growing and developing economies. The African continent contains mostly of underdeveloped and poor countries. The results can be used to reduce risk by making

sensible and effective decisions when validating a person or company based on available data. On the other hand, it also aims to detect fraud to track changes in behavior patterns on a network or site by detecting anomalies that may indicate such behavior. Meanwhile, it also contributes to a competitive advantage by providing valuable information, such as customer data, to have an advantage over other competitors. At some level, it can present production efficiency by forecasting inventory, production rates, and potential failures.

The map for the social support, GDP and life expectancy attributes are very similar to the happiness ranking attribute's one while generosity, freedom and corruption attributes have variation with distinct similarities; which further confirms the results elaborated in appendix of attribute mapping. Interestingly, the idea that subjective well-being such as happiness index can be captured in research somehow have been challenged by economists and politicians. Presumebly, they claimed that people's assessment of well-being should be identified various aspect such as spiritual and ecological, which predominantly those factors also can be influenced, for example, by the value of their country's education system and the social status. Thus, the way of subjectivity in measuring happiness index should be consistent and discussed further to allow fairer metric to be used respectively.

The results presented that to make a utopian state, the relevant party should achieve high GDP per capita, longer life expectancy and greater social support as well as a corruption-free, freedom-laden and generous state. In other hand, telecommunications service providers often use strategies extensively to identify potential customers and convince them to stay based on past information and past behavior to predict the future [31]-[35]. Meanwhile, physical hardware standardization, fault tolerance, and load balancing are key factors that improve the performance of cloud computing that occurs through virtual machine migration (VM). Thus, energy savings can be achieved by energy prediction using various machine learning techniques [36]-[39]. Cardiorespiratory fitness studies, on the other hand, often use regression analysis to predict heart and respiratory conditions and future outcomes [40]. In addition, data identification technology is an effective technique for guiding analysts and extracting new knowledge. Therefore, new problematic OLAP emerged, linking its principles with data extraction methods to enhance online analysis and not be limited to simple research and simple data visualization [41]. Interestingly, common algorithms such as K-nearest neighbors, naive bayesian, decision trees, and support vector machines are not consider best in term of effectiveness and accuracy by comparing linear regression, additive regression, and decision stumps to show the level of effectiveness and accuracy to generate a linear prediction [42]-[44].

4. CONCLUSION

In conclusion, the study reaffirms our presumption that happiness is not a take-all-to-get-it object. Actually, it requires the right and proper concoction of factors to obtain it accordingly that is determine implicitly by the degree of freedom, corruption, generosity, social support, GDP and life expectancy from the country. Meanwhile, on the ethical side of things, the dataset does not contain any personal information of the participants who filled the survey, so there is no links that could potentially expose their identity and can be used against them and therefore is openly available to the public to be used and shared.

APPENDIX

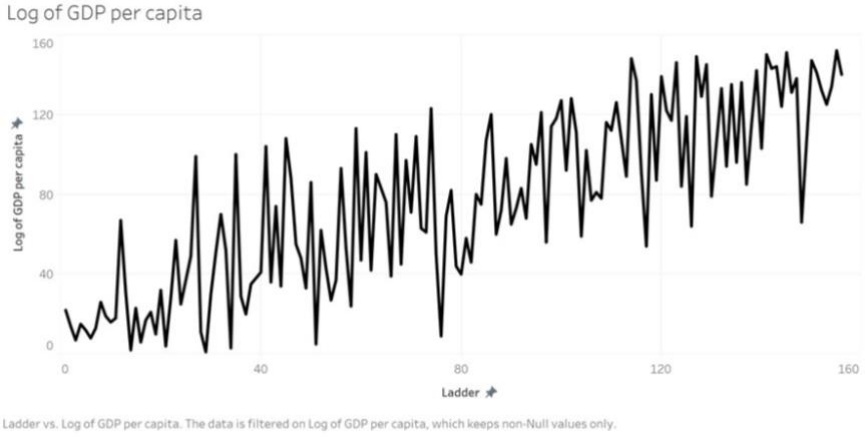

Figure 2. Main attribute with respect to the rank of happiness (*continue*)

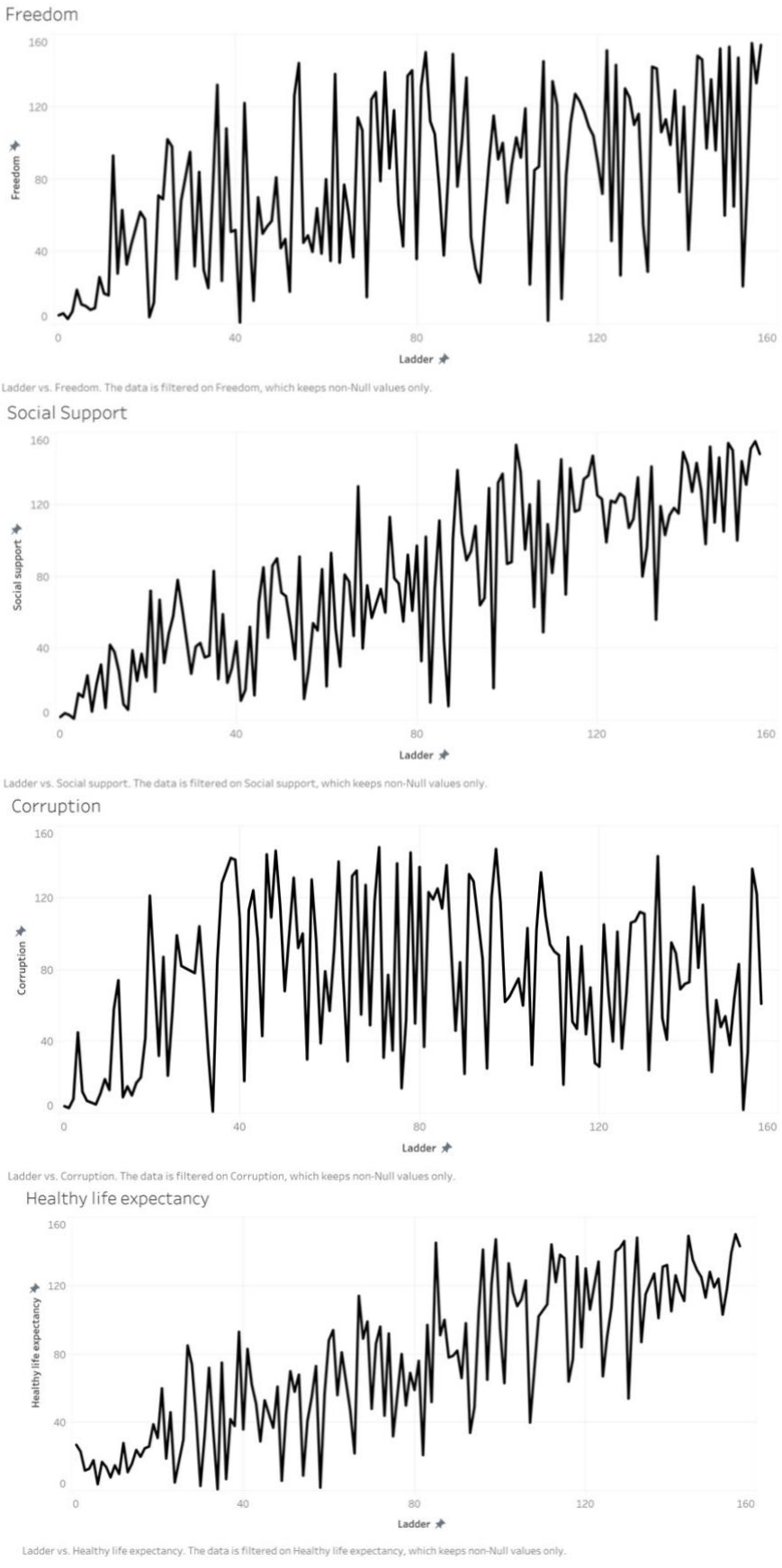

Figure 2. Main attribute with respect to the rank of happiness (*continue*)

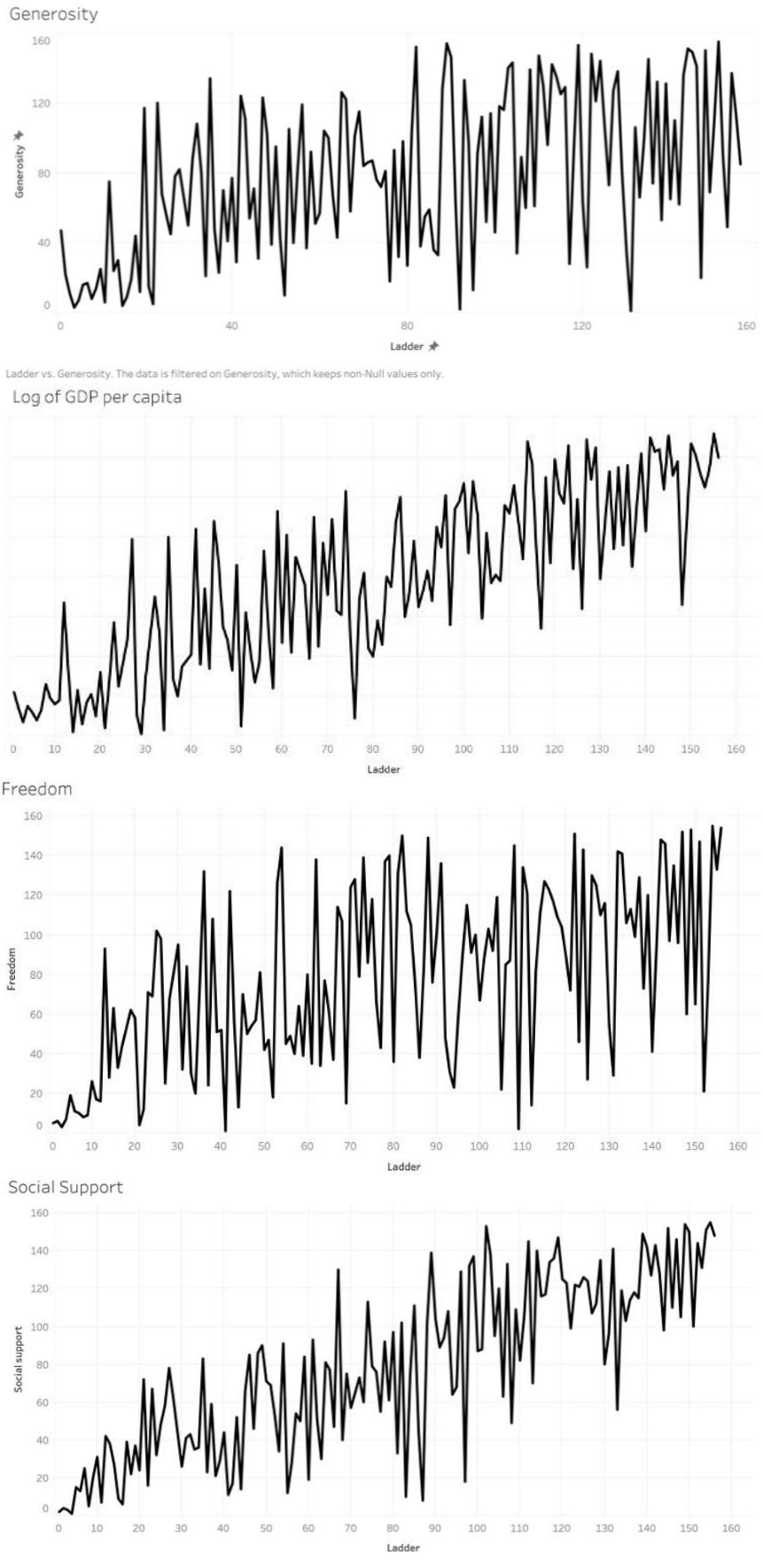

Figure 2. Main attribute with respect to the rank of happiness (*continue*)

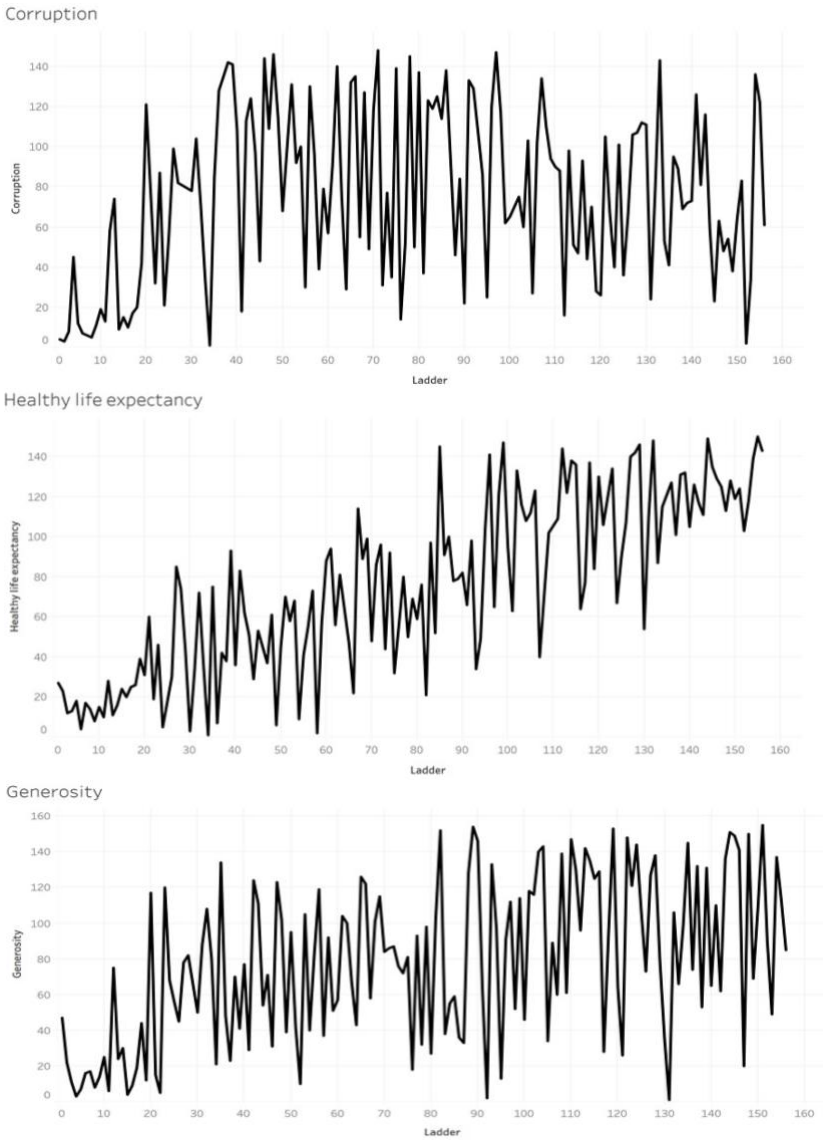

Figure 3. Main attribute with respect to the rank of happiness

Figure 4. World map visualization to show where the happiest and least happy countries are plus how other factors work out (*continue*)

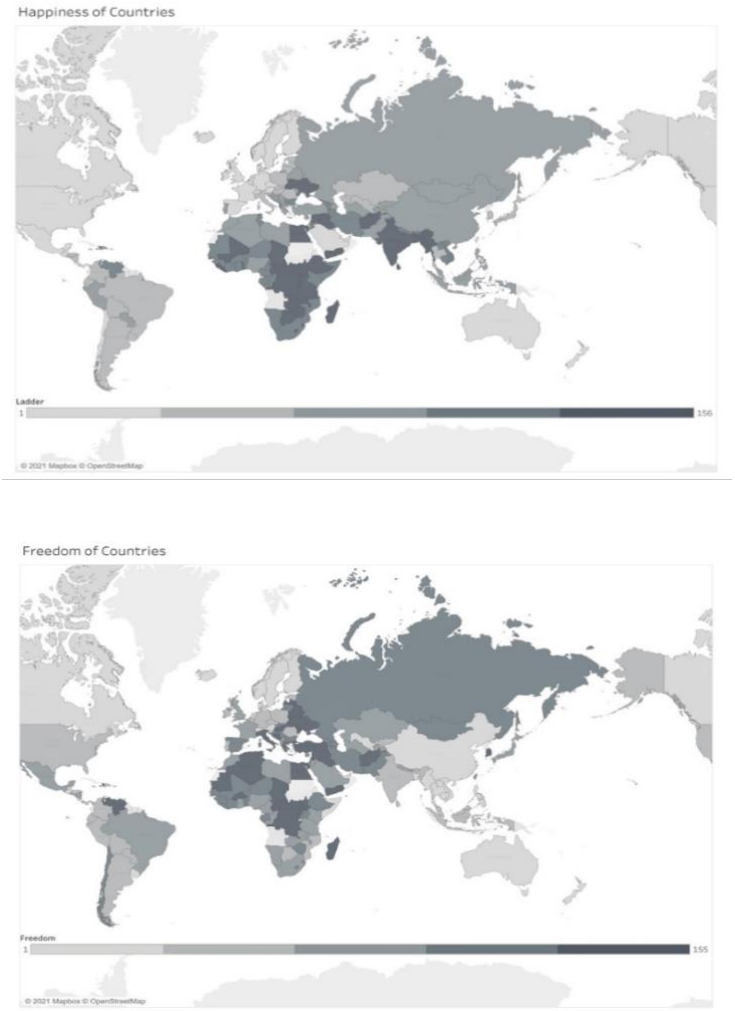

Figure 4. World map visualization to show where the happiest and least happy countries are plus how other factors work out

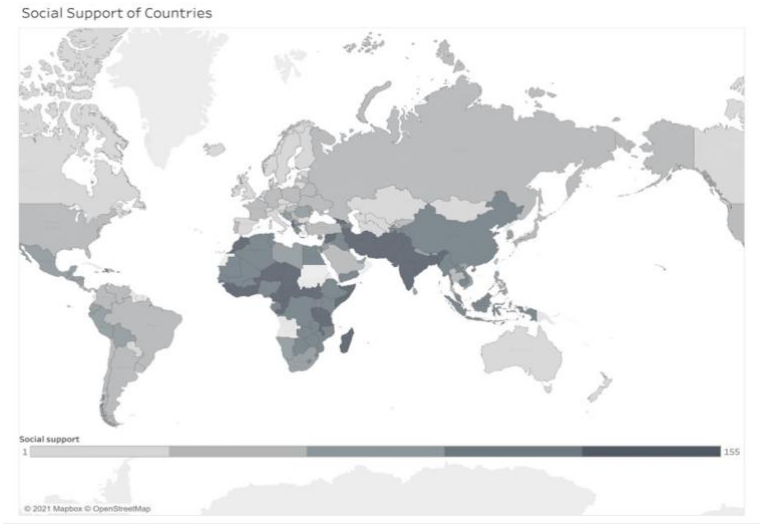

Figure 5. World map visualization to show where the happiest and least happy countries are plus how other factors work out (*continue*)

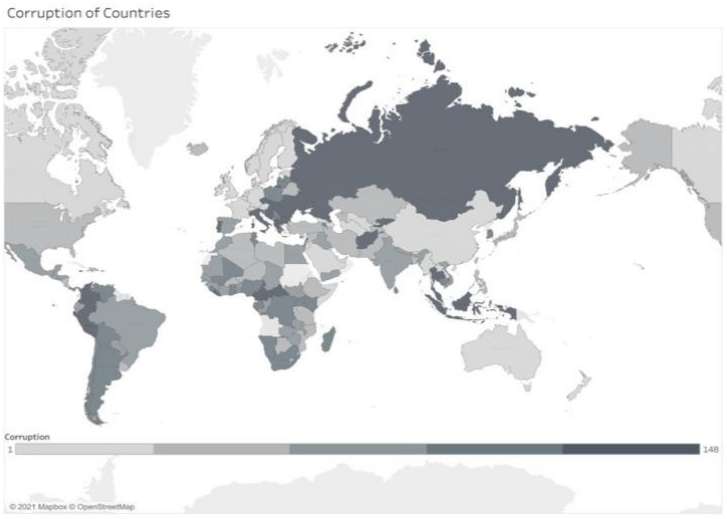

Figure 5. World map visualization to show where the happiest and least happy countries are plus how other factors work out

REFERENCES

[1] W. Liu, Q. Wu, J. Shen, J. Zhao, M. Zidan, and L. Tong, "An optimized quantum minimum searching algorithm with sure-success probability and its experiment simulation with Cirq," *Journal of Ambient Intelligence and Humanized Computing*, vol. 12, no. 11, pp. 10425–10434, Nov. 2021, doi: 10.1007/s12652-020-02840-z.

[2] M. Zidan, "A novel quantum computing model based on entanglement degree," *Modern Physics Letters B*, vol. 34, no. 35, Art. no. 2050401, Dec. 2020, doi: 10.1142/S0217984920504011.

[3] M. Zidan, H. Eleuch, and M. Abdel-Aty, "Non-classical computing problems: Toward novel type of quantum computing problems," *Results in Physics*, vol. 21, Art. no. 103536, Feb. 2021, doi: 10.1016/j.rinp.2020.103536.

[4] M. Zidan *et al.*, "A quantum algorithm based on entanglement measure for classifying Boolean multivariate function into novel hidden classes," *Results in Physics*, vol. 15, no. May, Art. no. 102549, Dec. 2019, doi: 10.1016/j.rinp.2019.102549.

[5] A. Sagheer, M. Zidan, and M. M. Abdelsamea, "A novel autonomous perceptron model for pattern classification applications," *Entropy*, vol. 21, no. 8, Art. no. 763, Aug. 2019, doi: 10.3390/e21080763.

[6] M. Zidan, A.-H. Abdel-Aty, A. El-Sadek, E. A. Zanaty, and M. Abdel-Aty, "Low-cost autonomous perceptron neural network inspired by quantum computation," in *AIP Conference Proceedings*, 2017, vol. 1905, Art. no. 020005, doi: 10.1063/1.5012145.

[7] M. Zidan *et al.*, "Quantum classification algorithm based on competitive learning neural network and entanglement measure," *Applied Sciences*, vol. 9, no. 7, Art. no. 1277, Mar. 2019, doi: 10.3390/app9071277.

[8] A.-H. Abdel-Aty, H. Kadry, M. Zidan, Y. Al-Sbou, E. A. Zanaty, and M. Abdel-Aty, "A quantum classification algorithm for classification incomplete patterns based on entanglement measure," *Journal of Intelligent and Fuzzy Systems*, vol. 38, no. 3, pp. 2809–2816, Mar. 2020, doi: 10.3233/JIFS-179566.

[9] A. M., M. M., and C. J., "Happiness as a function of personality and social encounters," in *Recent Advances in Social Psychology*, Elsevier, 1989, pp. 189–203.

[10] S. Lyubomirsky and H. S. Lepper, "A measure of subjective happiness: preliminary reliability and construct validation," *Social Indicators Research*, vol. 46, no. 1999, pp. 137–155, 1999.

[11] E. Diener, R. A. Emmons, R. J. Larsen, and S. Griffin, "The satisfaction with life scale," *Journal of Personality Assessment*, vol. 49, no. 1, pp. 71–75, Feb. 1985, doi: 10.1207/s15327752jpa4901_13.

[12] D. Watson, L. A. Clark, and A. Tellegen, "Development and validation of brief measures of positive and negative affect: The PANAS scales," *Journal of Personality and Social Psychology*, vol. 54, no. 6, pp. 1063–1070, 1988, doi: 10.1037/0022-3514.54.6.1063.

[13] P. Hills and M. Argyle, "The Oxford Happiness Questionnaire: a compact scale for the measurement of psychological well-being," *Personality and Individual Differences*, vol. 33, no. 7, pp. 1073–1082, Nov. 2002, doi: 10.1016/S0191-8869(01)00213-6.

[14] M. Argyle and L. Lu, "Happiness and social skills," *Personality and Individual Differences*, vol. 11, no. 12, pp. 1255–1261, Jan. 1990, doi: 10.1016/0191-8869(90)90152-H.

[15] J. F. Helliwell, "Well-being, social capital and public policy: What's new?" www.gpiatlantic.org/conference/papers/helliwell.pdf (accessed Mar. 21, 2008).

[16] M. Csikszentmihalyi, *Flow: The psychology of optimal experience*. Harper and Row, 1990.

[17] J. Helliwell, R. Layard, and J. Sachs, "World Happiness Report 2019," 2019.

[18] C. O'Brien, "Sustainable happiness: How happiness studies can contribute to a more sustainable future," *Canadian Psychology/Psychologie canadienne*, vol. 49, no. 4, pp. 289–295, 2008, doi: 10.1037/a0013235.

[19] J. Neidhardt, N. Rümmele, and H. Werthner, "Predicting happiness: user interactions and sentiment analysis in an online travel forum," *Information Technology and Tourism*, vol. 17, no. 1, pp. 101–119, Mar. 2017, doi: 10.1007/s40558-017-0079-2.

[20] T. A. Vlahovic, S. Roberts, and R. Dunbar, "Effects of duration and laughter on subjective happiness within different modes of communication," *Journal of Computer-Mediated Communication*, vol. 17, no. 4, pp. 436–450, Jul. 2012, doi: 10.1111/j.1083-6101.2012.01584.x.

[21] R. Dunbar, "Theory of mind and the evolution of language," *In J. Hurford, M. Studdart-Kennedy and C. Knight (eds.), Approaches to the Evolution of Language*, pp. 92–110, 1998.

[22] G. Zhan, "Mobile internet and user happiness," *International Journal of Future Computer and Communication*, vol. 3, no. 4, pp. 291–294, 2014, doi: 10.7763/IJFCC.2014.V3.314.
[23] A. Aiello, L. J. Rosenberg, and J. A. Czepiel, *Scaling the heights of consumer satisfaction: an evaluation of alternative measures*. New York University, Graduate School of Business Administration, 1977.
[24] Z. Deng, Y. Lu, K. K. Wei, and J. Zhang, "Understanding customer satisfaction and loyalty: An empirical study of mobile instant messages in China," *International Journal of Information Management*, vol. 30, no. 4, pp. 289–300, Aug. 2010, doi: 10.1016/j.ijinfomgt.2009.10.001.
[25] S. Abdullah, E. L. Murnane, J. M. R. Costa, and T. Choudhury, "Collective smile: measuring societal happiness from geolocated images," in *Computer Supported Happiness*, Feb. 2015, pp. 361–374.
[26] A. Akın, "The relationships between internet addiction, subjective vitality, and subjective happiness," *Cyberpsychology, Behavior, and Social Networking*, vol. 15, no. 8, pp. 404–410, Aug. 2012, doi: 10.1089/cyber.2011.0609.
[27] J. Hinds and A. Joinson, "Human and computer personality prediction from digital footprints," *Current Directions in Psychological Science*, vol. 28, no. 2, pp. 204–211, Apr. 2019, doi: 10.1177/0963721419827849.
[28] S. Lyubomirsky, "Why are some people happier than others? The role of cognitive and motivational processes in well-being," *American Psychologist*, vol. 56, no. 3, pp. 239–249, 2001, doi: 10.1037/0003-066X.56.3.239.
[29] S. Lyubomirsky, K. M. Sheldon, and D. Schkade, "Pursuing happiness: the architecture of sustainable change," *Review of General Psychology*, vol. 9, no. 2, pp. 111–131, Jun. 2005, doi: 10.1037/1089-2680.9.2.111.
[30] S. Lyubomirsky and K. L. Tucker, "Implications of individual differences in subjective happiness for perceiving, interpreting, and thinking about life events," *Motivation and Emotion*, vol. 22, no. 2, pp. 155–186, 1998.
[31] N. Jaques, S. Taylor, A. Azaria, A. Ghandeharioun, A. Sano, and R. Picard, "Predicting students' happiness from physiology, phone, mobility, and behavioral data," in *2015 International Conference on Affective Computing and Intelligent Interaction (ACII)*, Sep. 2015, pp. 222–228, doi: 10.1109/ACII.2015.7344575.
[32] M. E. Seligman, *Flourish: A visionary new understanding of happiness and Well-Being*. Simon and Schuster, 2012.
[33] H. Cheng and A. Furnham, "Personality, self-esteem, and demographic predictions of happiness and depression," *Personality and Individual Differences*, vol. 34, no. 6, pp. 921–942, Apr. 2003, doi: 10.1016/S0191-8869(02)00078-8.
[34] F. J. Pérez-Benito, P. Villacampa-Fernández, J. A. Conejero, J. M. García-Gómez, and E. Navarro-Pardo, "A happiness degree predictor using the conceptual data structure for deep learning architectures," *Computer Methods and Programs in Biomedicine*, vol. 168, pp. 59–68, Jan. 2019, doi: 10.1016/j.cmpb.2017.11.004.
[35] R. K. Gupta, P. Bhattacharya, and Y. Yang, "What constitutes happiness? predicting and characterizing the ingredients of happiness using emotion intensity analysis," in *Proceedings of the 2nd Workshop on Affective Content Analysis@ AAAI (AffCon2019)*, 2019, pp. 1–11.
[36] J. Li, S. Roy, J. Feng, and T. Sim, "Happiness level prediction with sequential inputs via multiple regressions," in *Proceedings of the 18th ACM International Conference on Multimodal Interaction*, Oct. 2016, pp. 487–493, doi: 10.1145/2993148.2997636.
[37] M. Lubis, R. Fauzi, A. R. Lubis, and R. Fauzi, "A case study of universities dormitory residence management system (DRMS) in Indonesia," in *2018 6th International Conference on Cyber and IT Service Management (CITSM)*, Aug. 2018, pp. 1–6, doi: 10.1109/CITSM.2018.8674313.
[38] A. M. Naser alzubaidi and E. S. Al-Shamery, "Projection pursuit random forest using discriminant feature analysis model for churners prediction in telecom industry," *International Journal of Electrical and Computer Engineering (IJECE)*, vol. 10, no. 2, pp. 1406–1421, Apr. 2020, doi: 10.11591/ijece.v10i2.pp1406-1421.
[39] D. T. and P. P., "Power consumption prediction in cloud data center using machine learning," *International Journal of Electrical and Computer Engineering (IJECE)*, vol. 10, no. 2, pp. 1524–1532, Apr. 2020, doi: 10.11591/ijece.v10i2.pp1524-1532.
[40] P. B. Palmer and D. G. O'Connell, "Research corner: regression analysis for prediction: understanding the process," *Cardiopulmonary Physical Therapy Journal*, vol. 20, no. 3, pp. 23–26, Sep. 2009, doi: 10.1097/01823246-200920030-00004.
[41] A. Lamani, B. Erraha, M. Elkyal, and A. Sair, "Data mining techniques application for prediction in OLAP cube," *International Journal of Electrical and Computer Engineering (IJECE)*, vol. 9, no. 3, pp. 2094–2102, Jun. 2019, doi: 10.11591/ijece.v9i3.pp2094-2102.
[42] Meiliana, D. Trisnawarman, and M. Choirul Imam, "Prediction analysis of criminal data using machine learning," *IOP Conference Series: Materials Science and Engineering*, vol. 852, no. 1, Art. no. 012164, Jul. 2020, doi: 10.1088/1757-899X/852/1/012164.
[43] A. R. Lubis, M. Lubis, Al-Khowarizmi, and D. Listriani, "Big data forecasting applied nearest neighbor method," in *2019 International Conference on Sustainable Engineering and Creative Computing (ICSECC)*, Aug. 2019, pp. 116–120, doi: 10.1109/ICSECC.2019.8907010.
[44] R. Andreswari, I. Syahputra, and M. Lubis, "Performance analysis of heuristic miner and genetics algorithm in process cube: a case study," *International Journal on Advanced Science, Engineering and Information Technology*, vol. 11, no. 1, Art. no. 393, Feb. 2021, doi: 10.18517/ijaseit.11.1.11544.

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