MACHINE LEARNING BASED CLASSIFICATION OF BREAST CANCER DATA

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Abstract- Over the last two decades, machine learning has grown in popularity as a field of study. It's a type of artificial intelligence that uses a combination of statistical, probabilistic, and optimization techniques to allow computers to "learn" from previous examples. In cancer diagnosis and detection, machine learning is extensively applied. Machine learning has lately been used in cancer prognosis and prediction. Machine learning technologies can significantly enhance the accuracy of predicting cancer susceptibility, recurrence, and death, according to the better designed and validated studies. Machine learning algorithms have been used on a variety of datasets, including medical datasets. Numerous studies involving medical data classification on various platforms have already been published in the literature. Because data mining techniques are vital in predicting early-stage breast cancer, the accuracy of several machine learning methods will be explored in this study to predict the most effective categorization method. Different methods have been used on various datasets, including medical datasets. Numerous studies involving medical data classification on various platforms have already been published in the literature. With python machine learning libraries and CNN, the accuracies of three different machine learning algorithms, k-Nearest Neighbors (k-NN), Random Forest, and Decision Trees (D.T), were explored in this work. The Random Forest Classifier was found to be the most accurate when results were created using various appropriate parameters for each algorithm.

KEYWORDS

Breast Cancer, Machine Learning , Classification, Accuracy

I. INTRODUCTION

Breast cancer has several causes, including genetics, obesity, hormones, radiation therapy, and even reproductive variables. Every year, one million women are newly diagnosed with breast cancer; according to a World Health Organization report, half of them will die because the cancer is frequently detected late. Breast cancer is created by a single cell's mistake or mutation, which can be shut down by the system or induce uncontrolled cell division. If the problem is not resolved within a few months, masses of cells with incorrect instructions form. Malignant tumours spread to nearby cells, which can lead to metastasis or spread to other sections of the body, but benign masses cannot spread to other tissues and can only expand within the benign mass. Breast Cancer detection can be difficult in the early stages of the disease because there are no symptoms. However, after a series of clinical tests, an appropriate diagnosis should be able to distinguish between benign and malignant tumours. A good detection yields a low rate of false positives and false negatives.

Machine learning is a set of tools that may be used

to create and test algorithms that help with prediction, pattern recognition, and classification. Collecting data, selecting a model, training the model, and testing the model are the four processes of machine learning. The relationship between BC and ML is not new; it has been utilized for decades to classify tumours and other malignancies, forecast cancer-causing gene sequences, and define prognostic factors. The classification's goal is to assign each observation to a certain category.Random Forest, Decision Trees, and k-nearest neighbour were utilised in this work as machine learning classifiers. The goal is to figure out whether a patient's tumour is benign or malignant. In this study, we tailor three machine learning techniques for breast cancer categorization. The Wisconsin Breast Cancer Database is what we use. The goal of this paper is to use three classifiers in a data set to construct effective machine learning algorithms for cancer classification. The performance of each classifier will be assessed in terms of accuracy, training, and testing.

II. LITERATURE REVIEW

Many studies in the literature used Artificial Intelligence (AI) techniques to increase classification accuracy and time response for breast cancer detection. In this section, we present some research on the use of machine and deep learning methodologies to solve the problem of medical breast cancer diagnosis.

For breast cancer categorization, Arpit B. and Aruna T. presented a genetically optimised neural network (GONN) (malignant and benign). By introducing new crossover and mutation operators, they were able to improve the neural network architecture.

Na L. et al. proposed a hybrid feature selection strategy for breast cancer diagnosis, combining a gain directed simulated annealing genetic algorithm wrapper to remove redundant and irrelevant features from the feature space with a cost sensitive support vector machine (CSSVM) learning algorithm. This method can enhance classification accuracy while also lowering computing costs. The proposed approach is tested on Wisconsin Original Breast Cancer (WBC) and Wisconsin Breast Cancer Disease (WBCD) to ensure its efficacy. The proposed work performs well and reduces the number of calculations required.

Teresa A. j. et al. proposed utilising Convolutional Neural Networks(CNN's) to classify hematoxylin and eosin stained breast biopsy images. Normal tissue, benign lesion, in situ carcinoma, and aggressive carcinoma are the four types of medical relevance they provide. The proposed CNN architecture is intended to combine data from a variety of histological scales. The model is tested on photos from the Bioimaging 2015 breast histology classification challenge, which are high resolution, uncompressed, and annotated HE stain images.

Fabio A. et al. used a deep learning approach to classify breast cancer histopathological images from BreaKHis, a public dataset, using a deep learning approach. They proposed a method for final classification that relied on the extraction of image patches for training the Convolutional Neural Network (CNN) and the combination of these patches. This strategy avoids model changes, which can result in a more complex and computationally expensive design.However, paucity of data necessitates expensive experiments.

On the Wisconsin Breast Cancer datasets, Hiba A. et al. compared the performance of four classifiers: Support Vector Machine (SVM), Decision Tree (D.T), Naive Bayes (NB), and k Nearest Neighbors (k-NN).

A. SIGNIFICANCE OF SOFT SKILLS AND HUMAN VALUES

Learners who wish to make a bigger name for themselves in the cutthroat world, are expected to practise and master the fundamentals of value education. Dealing with the regular hectic workloads of extreme stress and cutthroat competitiveness demands an early foundation of ethical and human ideals. These attributes help prospective and practising engineers maintain their cool in the face of such challenges. It also provides pupils with the capacity to make ethical decisions in their everyday interactions. To deal with the stress of studying, we regularly hear about students committing suicide or indulging in risky behaviours such as drug abuse. A solid value foundation will ensure that youngsters are never forced to adopt radical steps that are not only destructive to them but also have a bad impact on those around them.

In today's work market, which is getting increasingly competitive in many professions. To be fruitful in this cutthroat environment, job seekers should have an "upper hand" that isolates them from other candidates with tantamount capabilities and assessment scores. After which the question arises: where do they get this upper hand. An extra edge can be gained over other candidates by introducing extra information and abilities within oneself, bolstered by persuading personal qualities and behaviours. This sounds all too familiar.

Businesses and start-ups, naturally, enlist candidates who will be productive enough from the beginning. Now if a graduate has to be taught how to frame appropriate content, how to give a stunning presentation, or how to communicate with clients and colleagues in a professional and winning manner, then that candidate would have very fewer chances of getting selected. Furthermore, a candidate having a basic understanding of business management, project management, and general economics will greatly increase his/her chances of getting selected.

B. TYPES OF SOFT SKILLS

In order to define the exact soft skills to be adopted and employed in the teacher education programme, extensive study and expert perspectives were sought. In light of the review of literature, seven soft skills have been recognized and decided to be applied in all educational organizations. They are as per the following:

(i)Communicative abilities -- The capacity to pass on thoughts adequately, and certainly, either verbally or recorded as a hard copy.

(ii)Thinking and critical thinking capacities -- The capacity to pass on thoughts plainly, successfully, and certainly, either orally or recorded as a hard copy.

(iii)Teamwork -- Ability to understand and be capable enough to switch between the roles of a pioneer and devotee.

(iv)Life-long learning and Information Management -- The capacity to find and deal with applicable data from an assortment of sources.

(v)Entrepreneurial aptitude -- The capacity to recognise work openings and suggest business prospects.

(vi)Ethics, morality, and professionalism -- Professional understanding of the economic crises, environment, and social-cultural factors.

(vii)Leadership abilities -- Knowledge of core leadership theories and the capacity to oversee group members [5].

C. TYPES OF HUMAN VALUES

The principles that are practised in personal and public life have been experimented with, and it has been suggested that our general public ought to be told dependent on these qualities and socially set up through training. These are some of the Human Values:

- Honesty
- Peacefulness (Love for humankind, administration of human empathy, all-inclusive love and so forth)
- Boldness
- Democracies (Rights, obligations, public incorporation and so forth)
- Sarva Dharma Sama Bhava (Composite religion, regard for others' beliefs, community togetherness)
- Gender equality (Untouchability removal, Not abusing civil rights)
- Independence (Swadeshi, respect of work)
- Finishes and means are both unadulterated (Integrity among thought and segments)
- Self-restraint (Self-control)
- Efficiency (Straightforwardness of life, Non-industrialism, Tasteful life) [6].

II. REVIEW OF LITERATURE

Deloitte Access Economic (DeakinCo, 2017), an association that offers a full set of financial warning administrations in Australia, including monetary estimating, displaying, examination, and warning administrations, forecasts that delicate expertise escalated occupations will represent 66 per cent of

all positions by 2030, up from half of all positions in 2000.

According to Wienclaws' (2015) study, Communication in the Workplace, in an exhaustive examination of notifications for passage level circumstances in the ordered regions of ten cities, the test reveals that the most frequently specified requirements for effective candidates were relational and relational talents (p. 8). Dabke (2015) explored sensitive talents as a universally long-lasting arrangement for assistants and discovered that they were also crucial abilities for supervisors.

Bonnie Urciuoli proposed in 2016 that "skills" with occupational demands of neoliberal economies, employees are expected to "own their talents" and effectively sell them to employers. In defining the function of soft skills, James Heckman, the recipient of the "Nobel Prize for Economics in 2000," maintains that "Soft Skills predict success in life" (Cinque, 2015). He discovers a link between soft talents and people's personal and professional success.

(Grisi, 2014) Soft skills provide hard skills with the versatility needed to advance and remain distinctive in changing work situations. Delicate abilities are integrally related with pliable, reasonable, expounding skills produced in Man's prefrontal layer over the previous 50.000 years. If hard abilities allow a man to be who he is: an architect, physicist, logician, delicate abilities work toward a path that is somewhat disconnected from the individual's vocation and goes beyond the harsh demands of the calling.

Maggiori et al. (2013) investigate the pressures and changes in the cutting-edge working environment, as well as the strain on persons exploring their vocation paths and the need for flexibility for advancement. Niles and Harris-Bowlsbey (2013) emphasise the importance of lifelong learning in career progression. The article provides evidence to build and prepare mid-career specialists to investigate the changing scene, demonstrate skills for flexibility, and the delicate abilities to advance into positions of leadership in their associations or work surroundings.

Chudzikowski (2012) explores the boundaryless profession and the need for vocation shift preparation for people as they investigate what she refers to as the turbulent ways that unfold across many authority, word related, and social situations (p. 298). Robles (2012) examined 90 business leaders to identify the top ten skills deemed most crucial in today's workplace. 49 people responded, and Robles and his team used the full list to narrow down the top ten talents. The following are the top 10 skills identified by Robles in his assessment (2012, p. 455):

- Accountability: accountability
- Flexibility: adaptability, life-long learner, adjusts, welcomes new experiences, readiness to change, and is teachable. Communication skills: oral, presenting, writing and listening.
- Courtesy includes manners, being nice, business etiquette, etiquette, saying please and thank you, and being respectful.
- Professionalism: well-dressed, business-like, and composed look.
- A positive attitude is one that is upbeat, energetic, encouraging, cheerful, and self-assured.
- Integrity: Being honest, having personal values, moral, ethical, and doing what is right.
- Interpersonal Skills: pleasant, with a sense of humour, likeable, caring, sympathetic, kind, with self-control, patience, sociability, warmth, and social skills.

Burke and Attridge (2011) deconstructed a list of qualities, abilities, and foundation influences that evaluated the major criteria for career

accomplishment and ranked relational abilities and strength/adaptability first. When stages of work and life are evaluated in relation to professional performance, Cairns and Malloch (2011) allude to the shifting landscape of work in the twenty-first century. As delicate abilities, K. (Prasad, 2011) lists ten characteristics such as modesty and fearlessness, passionate insight (EQ), expanding on qualities and disapproving of your centre inadequacy, affectability to setting, overseeing discernment, appreciation for other people, jobs, centre around outcomes, and cycle.

(Cedefop, 2010) The European Center for the Development of Vocational Training has exposed the assumptions of various organisations and strategy makers who claim that these issues develop as a result of insufficient preparation of understudies and other workers. They claim that the skills mismatch that is occurring locally will continue to result in high unemployment in global economies. Klaus (2010) discovered that "delicate talents," or the relational abilities and character attributes required for effective collaboration, are a better predictor of long-term professional accomplishment than specialised abilities.

Bridgstock (2009) Alumni of higher education are usually inadequate in their ability to organise, modify, and consciously apply their specific talents to new contexts and conditions. The talents that are important to employability and career success are not only the hard abilities such as intellectual and specialised abilities, work explicit and discipline-explicit capacity, but also the supposed delicate abilities. (Roselina, 2009), a researcher at the Malaysian Institute of Higher Learning, defines delicate talents as combining aspects of traditional skills.

Numerous studies (King 2003; Mourshed 2012, Yunus & Li 2005) have highlighted significant concern about the widening gap between students' skills and capacities and the demands of the workplace in an increasingly mobile and globalised world.

As indicated by Costin G. (Costin, 2002), the legitimate and talented utilization of hard abilities depends on delicate abilities. He isolates hard abilities into those connected to "item" and "individual," while delicate abilities are those identified with "interaction" and "local area": he proposes a delicate expertise hard ability continuum to remind us to be ready to separate the two. A worldview like this makes it simple to see the space in which delicate and hard gifts crossover, fix, and work together.

In his paper "The Soft Skills of Business English," (Nieragden, 2000) characterizes delicate capacities as "those individual convictions and relational abilities that decide an individual's ability to coordinate into a particular construction, for example, an undertaking group, a stone gathering, or a firm."

As indicated by (Paajanen, 1992), delicate expertise is a sociological term identifying with a people EQ (Emotional Quotient), the group of character characteristics, basic manners, correspondence, language, individual propensities, benevolence, and idealism that describe associations with others. An Australian review by Stevenson and Mckavanagh (Stevenson and McKavanagh, 1992) contends for a more far-reaching perspective on abilities and states the requirement for the more subtle yet significant adaptable abilities like figuring out how to learn, revelation, examination, critical thinking, experimentation, connecting new ideas with existing information, relating verbal and non-verbal portrayals and cement objects, investigating and deciphering.

Carl Rogers (Roger C. 1983), in dissecting the goal of the instructive cycle, ensures that critical learning unites the intellectual and the instinctive, the

astuteness and the believing, the concept and the experience, the thinking and the significance. When we learn in this manner, we are whole. This remark obviously expresses the notion that in order for true learning to occur, it must contain something other than the acquisition of static knowledge. According to Rogers (Roger, 1983), the goal of advanced education is to aid in advancement and learning. According to him, the primary individual who is trained is the one who has learned how to study, the one who has worked out how to adapt and modify; the one who has realised that no information is safe and that the most popular method of searching for information provides a justification for security. He notices that changes, reliance on process rather than static knowledge, is the major factor that bodes well as a goal for education in the cutting-edge world. Regardless of the fact that the proclamation was made nearly 40 years ago, it is still valid for the current instructive setting and, in our opinion, it is probably the most eloquent case that attempts to demonstrate that intellectual knowledge alone isn't sufficient to remain required in a temperamental world.

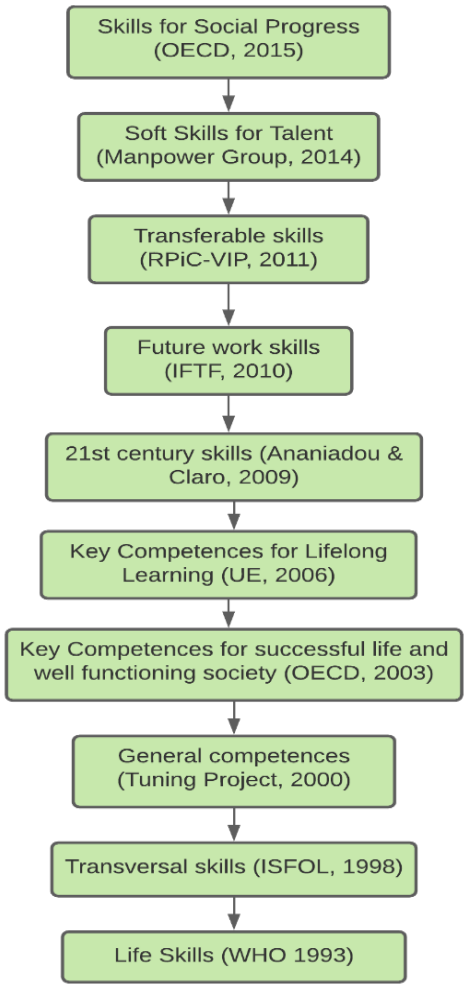

Fig 1. Proposed names to the term "soft skills" in reverse chronological order

Analysing the offered definitions, we can conclude that, despite their apparent divergence, there are essential features that unify all recommended versions for the word, and these may be characterised as follows:

- Soft skills are essential for gaining employment and excelling in the job.
- Delicate talents are essential not just for the job market, but also for achieving fulfilment in everyday life.
- Soft skills categorization and evaluation are complicated procedures that do not fit the

standard model.

- These skills can be used outside of the workplace. Soft skills, as opposed to hard skills, are a person's collection of talents and abilities that allow them to perform a certain sort of task or activity. Soft skills are largely interpersonal skills that may be employed in a range of industries, making them transversal.

III. OBJECTIVES OF THE STUDY

IV. RESEARCH METHODOLOGY

A survey was conducted to get the real-time data which focuses on third-year students of NIIT University, wherein a questionnaire was conducted based on their inter-human values and soft skills, along with interviewing a few of the students, regarding their progress in the last 3 years. The record of the data was collected and stored in .csv format(Excel Sheet). Using this data, we are developing a machine learning model in Python, Jupyter Notebook(Anaconda) that will predict the academic progress of a student in binary format, as well as the association between these variables. Aside from that, we are contrasting the enhancement of human values versus soft skills in this age generation, as well as their perspectives on their progress in three consecutive years from 2019 to 2021.

V. DATA ANALYSIS

Study of the Year 2019-2021

The questionnaire was distributed through Google Form to the Batch of 2019, NIIT University students who are currently enrolled in the third year of their curriculum. The questionnaire was filled in accurately and completely by 19 of the batch's pupils. The purpose of this study was to investigate what changes students saw in their soft skills and human values over the course of three years at university.

Students were asked to rate themselves on a scale of 1-5 on 10 different values and 10 different soft skills over the course of each year, and the mean of all 19 entries for a particular soft skill or value was taken to show what the average growth of the student was for a particular year, allowing us to compare the variation in a student's growth over the course of a year.

ss(soft skill)/ hv(human values	**2019**	**2020**	**2021**
communication_ss	3.11	3.32	3.68
conflict_Management_ss	3.21	3.63	3.68
Critica_Thinking_ss	2.79	3.47	3.68
Decision_Making_ss	3.11	3.21	3.74
Emotional_Intelligence_ ss	3.11	3.42	3.47
Leadership_ss	2.95	3.00	3.37
Self_Confidence_ss	3.53	3.74	3.79
Teamwork_ss	3.63	3.89	3.95
Time_Management_ss	3.21	3.63	3.74
Positive_Attitude_ss	3.89	3.95	4.11
Belief_hv	3.53	3.74	3.84
Non_Violence_hv	3.74	3.63	3.58
Self_Confidence_hv	3.37	3.42	3.74
kindness_hv	3.84	4.11	3.89
Integrity_hv	3.74	3.63	3.68

Health_And_Energy_hv	3.89	3.84	3.84
Gratitude_And_Appreciation_hv	3.63	3.84	3.89
Happiness_hv	3.95	3.84	3.89
Friend_Friendship_hv	3.95	4.00	4.00
Peave_hv	3.48	3.65	3.77

According to the study results, students were least confident in their leadership abilities. Some talents, such as critical thinking, time management, and emotional intelligence, have improved with time. The friendliness and good attitude are the sole factors that contribute to the 4 out of 5 ratings.

Academic vs Soft skills and Human Values

Students were also asked to rate their academic achievement in each academic year in a binary format, i.e. 0 or 1, where 1 signified success or improvement in academic results, while 0 signified failure or reduction in academic results. This study was conducted to determine how a student's soft skills and values impact his or her academic performance. The average of all student's soft skills and human values was calculated and compared to their academic results.

undergraduate List	Average of soft skill and human value out of 5	Academic Result based on clustering
undergraduate 1	3.87	1
undergraduate 2	3.64	0
undergraduate 3	3.68	1
undergraduate 4	3.13	0
undergraduate 5	2.78	0
undergraduate 6	3.53	1
undergraduate 7	3.87	1
undergraduate 8	3.94	1
undergraduate 9	3.50	1
undergraduate 10	3.81	1
undergraduate 11	4.10	1
undergraduate 12	3.14	1
undergraduate 13	3.95	1
undergraduate 14	3.40	1
undergraduate 15	3.64	0
undergraduate 16	3.41	0
undergraduate 17	3.31	0
undergraduate 18	3.16	0
undergraduate 19	3.37	0

The preceding data shows that the average value of success is 3.71, which suggests that any student with an average score of soft skills and values more than or equal to 3.71 is most likely to succeed. Despite their low grades, some students were able to achieve success in their ambitions or improve their academic outcomes. Student 12, for example, had an overall score of 3.14. He was successful because of collaboration, a good attitude, and the highest satisfaction rating of happiness among all pupils.

The above example demonstrates that the average score does not always accurately show the real or true result. To predict more exact results, we employed some of the Machine Learning techniques to create a hypothesis function that can cluster academic success or failure based on data from the student's soft skills and values.

Identification of Academic Success or Failure through Machine learning

Because clustering is a supervised learning Machine learning method, we already had an actual dataset of 19 student's successes and failures with us.

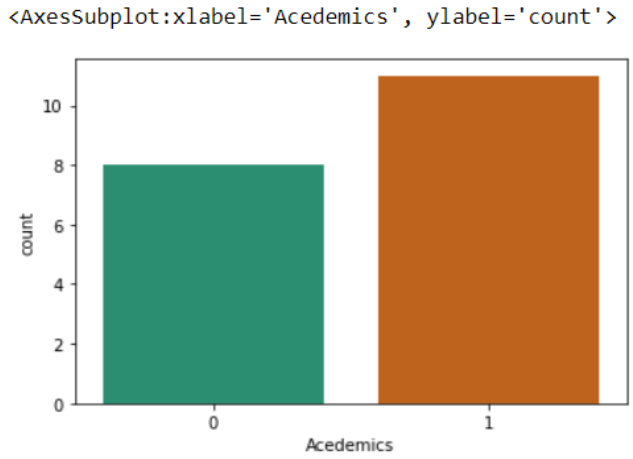

Fig 2. Count of students with improved and unimproved academics over three years

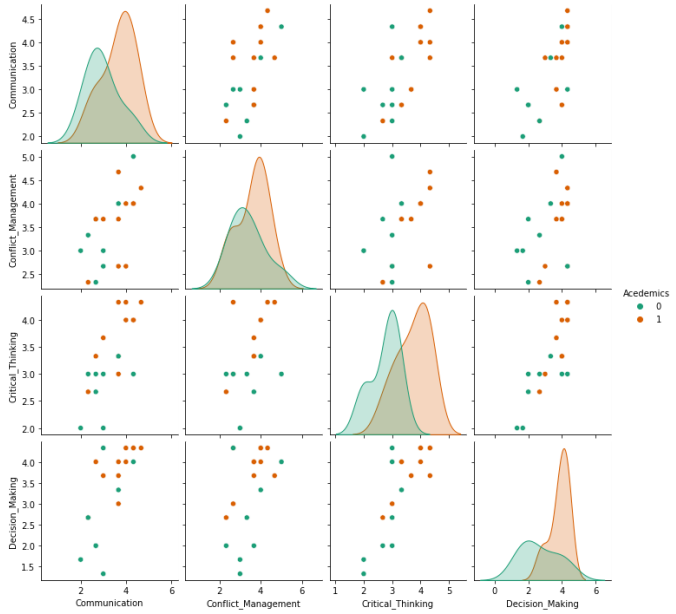

Fig 4. Correlation between different soft skills and values

To have a better understanding of the data, we created a correlation table between all of the elements (soft skills and human values) and visualised it with pair plotting and a heatmap.

Since the size of the correlation table and plot was huge we have shown a part of their result.

	Communication	Conflict_Management	Critical_Thinking	Decision_Making
Communication	1.000000	0.598364	0.725316	0.716407
Conflict_Management	0.598364	1.000000	0.469184	0.463988
Critical_Thinking	0.725316	0.469184	1.000000	0.811366
Decision_Making	0.716407	0.463988	0.811366	1.000000

Fig 3. Soft skill and values correlation table short

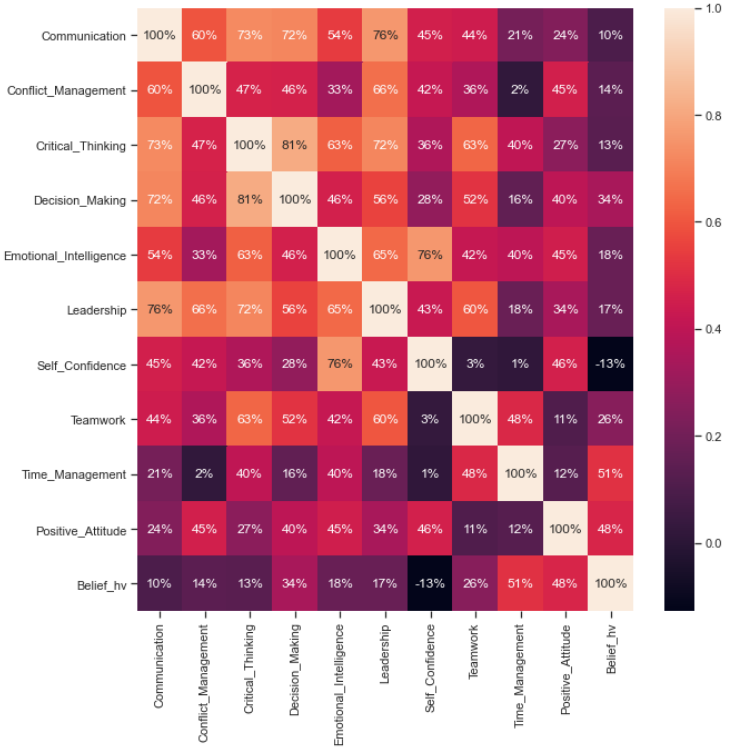

Fig 5. Heatmap of correlation between the soft skills and values

To train the data, we employed five clustering algorithms:random_forest_classifier,logistic_regress

ion, K_closest_neighbour, decision_tree_classifier, and final SVM (support vector machine). The training accuracy across the nine datasets we received:

```
[0]Logistic Regression training Accuracy: 1.0
[1]Decision Tree training Accuracy: 1.0
[2]Random Forest Classifier training Accuracy: 1.0
[3]KNN training Accuracy: 1.0
[4]SVM training Accuracy: 1.0
```

Fig 6. Training accuracy of clustering algorithms

Because our training dataset was tiny, getting 100 percent accuracy in all clustering techniques was rather usual. However, validating the model over training data, i.e. our remaining 10 datasets from various students, determines if the model was correctly trained or not.

```
[[3 2]
 [0 5]]
Logistic_Regression testing Accuracy =  0.8

[[2 3]
 [1 4]]
Decision_Tree_Classifier testing Accuracy =  0.6

[[2 3]
 [0 5]]
Random_Forest_Classifier testing Accuracy =  0.7

[[3 2]
 [0 5]]
KNN testing Accuracy =  0.8

[[3 2]
 [0 5]]
SVM testing Accuracy =  0.8
```

Fig 7. Testing accuracy of clustering algorithms

The Logistic Regression, KNN, and SVM models had the highest accuracy over the test data. The predicted outcome was obtained by the top three performing models on the test data.

```
Acedemic_Actual_Result= [1 0 1 0 0 0 1 0 1 1]

Logistic_Regression_Result= [1 1 1 0 1 0 1 0 1 1]

KNN_Result= [1 1 1 0 1 0 1 0 1 1]

SVM_Result= [1 1 1 0 1 0 1 0 1 1]
```

Fig 8. Logistic regression, KNN and SVM supervised learning result compared with the actual result

Python Algorithms will assist us in better predicting the outcome based on a student's skill set rather than the prediction from the curve of the mean of the data.

CONCLUSION

With the beginning of financial progression, the Indian market is becoming worldwide. It is now basic for everybody to get fitting abilities and human values past scholarly or specialized knowledge. Accordingly, the qualities of both should be inculcated in learners with the end goal for them to exhibit their actual potential at global levels. Until the last few decades, expert accreditation was adequate. Following late emergencies in the business and expert domains, it is presently important to have an astounding character and a legitimate mentality in addition to a brilliant degree. Human abilities and values can be considered as keys to unlocking the prevailing global issues. A few people already have the in-built polish and appeal expected to make that need a triumph, while others should learn it, and the individuals who won't awaken to the call of great importance are unfortunately stunned out of their sleep when an abrupt need comes.

Finally, the data analysis demonstrated the importance of soft skills and values in terms of character and academic performance. To improve

your general progress and happiness in life, one should review their talents. We also discovered that there is a strong link between skills and values and that in university life, the university plays an important role in instilling both in students. Our python model heatmap also showed a significant association between the talents, such as the need for communication skills for greater leadership, emotional intelligence, decision making, and critical thinking. Finally, it concludes that in order to be a great leader tomorrow, the journey must begin now.

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