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Work-Life Balance Analysis Score Model

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ABSTRACT---Most of the companies are finding innovative ways to provide work-life balance to employees. Some of the measures creches for their children, flexible work timings, paternity leaves among others. Some of the companies are looking at technology to provide a better work-life balance. With the increasing need for a more integrated model of analyzing the work-life balance, in this manuscript, a contemporary model of machine learning-based work-life balance score analysis system is proposed, which indicates potential performance over the training and test pattern used for analysis. Though the scope for improving the accuracy of the system exists, still in terms of the pragmatic application of the model, it can be stated that the model is effective and has a scope of implementation over the real-time conditions.

Keywords - Work-Life Balance, Machine learning in work-life balance, ML-WLBI, Neal Whitten Work-Life Model.

I. INTRODUCTION

1.1 Outlook

The old saying of "health is wealth" has inherent facts integral to the quality of living. Alongside the numerous positive developments that are imperative in the current world, there are many significant challenges too, which are being integrated into the quality of life by the people. There is a paradigm shift in the way organizations and businesses are focusing on developments, Work-life balance is one of the major epidemic paving ways to many unhealthy lifestyle conditions[1].

In a pragmatic scenario, the changing fast pace of life, wherein the people are being emphatical on professional achievements, accomplishing the lifestyle goals and other such dynamics are derailing the purpose and vision of quality life. The increasing set of juvenile diabetic conditions, depression symptoms in the teenage kids are reflecting on the increasing imbalance of work-life. Also, in the young generation employees, extended hours of working, high-pressure work environment, lack of happy family environment and many other factors combine to create significant challenges for quality living to the customers.

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It is imperative that with the emerging technological advancements, even in the medical domain, the usage of technology solutions has become a significant solution. The scope of work-life balance is a combined effort wherein all the stakeholders like the people, society, government regulations, employers and all put together an effort towards enhancement and improvement in overall quality of development.

However, taking in to account the conditions the current scenario of work-life balance conditions, some of the research studies have focused on using the data science to reflect on the problem and towards identifying possible solutions that could be used by the organization towards improving the conditions of work-life balance analysis[2].

Some of the contemporary solutions emerging in the current scenario are using automated solutions in certain complex work tasks in the perception of easing the human work efforts and reduce the stress on the individuals. Solutions like the machine learning models were proposed by some of the earlier studies towards improving the conditions that can support in improving the overall business process. Improvements in the business also should focus upon wellbeing of the people who are integral to the organizational environment. In a few of the countries like Bhutan, the happiness index is one of the metrics considered for the well-being and development analysis of the nation. Taking such factors into account, it can be stated that if there is a comprehensive system that can be used for the analysis of a comprehensive system, it shall enable in tracking the work-life balance conditions among the employees.

1.2 Gap Evaluation

Human emotions come from birth and growing up environment. These emotions are exhibited in personal life and professional life. At times personal life problems can influence work and vice versa. Due to this, organizations are facing a challenge to have a workforce that is motivated and passionate about their work. Due to changing business needs, employees are putting long work hours coupled with travel in crowded cities. Apart from this the stress factor in the job is taking a toll on employee health. These would affect their personal life and would indirectly influence their productivity. This, in turn, would increase overall organizational productivity[3]. Most of the companies are finding innovative ways to provide work-life balance to employees. Some of the measures creches for their children, flexible work timings, paternity leaves among others. Some of the companies are looking at technology to provide a better work-life balance.

A study says that rather than improving productivity, technology has decreased the productivity of employees, despite adopting technologies like cloud & mobile. Organizations are exploring how emerging technologies like artificial intelligence and machine learning can help to improve productivity [2].

Bank of America is in the process of introducing a chatbot named Erica that would help customers with their queries. With the chatbot, Bank of America believes that customer relationships will improve with the introduction. With this Bank of America believes, employees need not handle certain complex tasks like customer service.

The chatbot will help customers check balances, handle bank transfers, pay bills and many more, which would increase the productivity of employees. This would substantially decrease stress levels on employees and would further help them to spend quality time with their loved ones or doing activities they love. Companies like Fujitsu are in the process of building applications using machine learning and artificial intelligence that would reduce employee stress levels and improve their productivity. These applications would make a process like onboarding, HR services and other admin related activities simple and would take that pressure from employees.

1.3 Machine Learning in Work-life Balance Solutions

Advantages of artificial intelligence and machine learning in building strong work-life balance are

- These technologies would help to automate most of the repetitive or mundane work. This would help employees work on exciting things rather than routine works.
- The management of an organization would become easier. With data, systems would be able to handle approvals and permissions needed based on previous cases.
- These technologies would use data collected by organizations in the past and help managers make informed decisions, making them go through less stress.
- With the increase in the use of modern technologies, organizations would be able to plan and execute business strategies with better productivity. These systems equipped with AI and ML can handle complex tasks like delegating and scheduling, thereby reducing stress on the team members.
- Advanced technologies can give personalized suggestions to users based on their activities and the work they handle. This would in turn help in increasing productivity.

There are a number of third - party applications that have come up using advanced technologies like artificial intelligence and machine learning. These applications are built to increase productivity. One of the recent examples is Google goals, part of Google calendar which uses AI and ML to provide data-driven intelligence suggestions, that would help to plan the day better. It can suggest a time to exercise or to work or spend time with family based on productivity and past behavior patterns [4]. Experts are now looking at work-life fulfillment rather than look at work-life balance. Technologists suggest the use of advanced technologies will help organizations create an environment that would increase work-life balance and would become work-life fulfillment. It is imperative to summarize, how technology would evolve and find innovative ways to find solutions to problems faced. It depends on the usage of this technology and how individuals use these tools to balance their life and lead happily.

1.4 Scope of Research

One of the key areas in the case of the work-life balance is about having a system of quick assessment wherein using simple metrics the work-life balance index score of an individual can be checked for the levels of work-life balance an individual is able to cope. In combination to many of the existing efforts from the people, this kind of system can support in developing a comprehensive outlook of how the further actionable strategies can be initiated by the organizations to give personal attention to the people who are prone or under significant imbalance of work-life balance. However, the dimension in which the system is assessed is profoundly about understanding that sensitivity in the case of an organizational process should be integral to the system or in the implementation of the system. The scope of handling the work-life balance too is about ensuring that there is some balancing mechanism in the organizational process, wherein the employees do not carry the personal duress to the work or the work duress to the personal life. The context is taken into account as, in the case of the personal based evaluation, there are potential chances that the individual assessing the score index might be prone to duress or biased conditions or unrealistic in the assessment conditions, which might lead to improper assessment. Similarly, even assessing every day tens and hundreds of people scores might lead to inconsistency in the outcome. Hence, taking such factors in to account, if there is a machine learning-based algorithm that can get trained over the assessment patterns, and if provided to analyze the conditions, there are potential chances that the inputs that are discussed in the system could be more effective and integral to handling the process of assessment without any disparity in the system and scope of assessment [2].

1.5 Organizing of the Paper

In the further section (section 2), some of the relative work pertaining to usage of the machine learning and AI models in the work-life balance arena is discussed. Followed by, in section-3 the emphasis is on the proposed solution, the feature selection models, classifier model used for the system and the algorithm proposed for the solution are discussed. Also, the test results of the solution are discussed in section 3. Section-4 concludes the dynamics of the proposed solution and the scope of future work which can be considered with the proposed model.

II. RELATED WORK

In [4], authors want to understand how work-life balance is affected by technology both advantages and disadvantages. The authors also want to propose a Smart Service system for work-life balance. From reviewing literature, authors understand that shift system in work, longer work hours are factors for work-life imbalance.

The authors propose work-life optimization that would use existing models and use information technology to make better of work-life balance.

This would give organization specific inputs for improving work-life balance. The authors conclude that work-life optimization system can improve work-life balance and improve the overall productivity of the organization [4].

In [5], the authors focus to understand, and the study has spoken and unspoken emotions. The authors state that many researchers have worked on understanding emotions and how they can be detected through perception and various theories on psychology. In this paper, the authors try to understand emotions by applying complex algorithms that run on machine learning. For the research, the authors have taken real-life data from a call- center and applied machine learning technique to understand emotions.

The authors conclude that their study is close to other research's happened in this area. However, authors believe with more data, the results will be more accurate [5].

In [6], Mesko and et.al try to understand how artificial intelligence can address resource crunch problem persisting in health care. The authors state that due to different factors, there is a resource crunch in the health care industry. The authors are confident that artificial learning along with machine learning and deep learning can provide certain solutions to this problem. The authors quote various examples of intelligent systems that are complementing medics. One of such examples is IBM Watson oncology that can help medical practitioners with treatment options. The authors conclude that AI and other advanced technologies might not solve the resource crisis but might help to overcome it. However, due to ethical and dangers associated with it, authors feel having better working conditions in hospitals can improve the situation [6].

In the study [7], the authors state that despite many physicians reporting burn - out, there has been no prior research that has happened in the area of understanding Physicians burn out as per their knowledge. To understand work-life balance of US physicians, authors send a questionnaire to fill. Of the total requests sent, 26% of doctors sent the filled form. A careful analysis of the results by applying various statistical methods, the researchers state that nearly 50% of physicians are suffering from one burn out or the other. The author's results show that doctors who handle specialty health care are more prone to burn out and it needs immediate attention, as they are at high risk [7].

III. ML-WLBI& RESULTS

3.1 Framework of Proposed Model

The proposed framework is about developing an algorithm model which has two significant component bases as personal life index and professional life index. Though the objective is about developing a comprehensive score model, it is as well important to understand the intrinsic elements behind any kind of imbalance. For instance, if the overall score is low or moderate and the personal index score is very low, it reflects that the person has the need to focus on the personal relationships and lifestyle conditions. Vice versa, if the score is poor in the case of the professional relationships, in such scenarios, the emphasis must be setting the context right in the professional engagements.

In the case of the proposed model, the emphasis is on selecting features from both personal and professional lives, which shall be developed into an index scoring pattern, wherein the score assessed for the individuals shall be attributed for both the conditions.

The features identified for each of the section is categorically based on the key attributes or factors discussed in the literature as key triggers for the stress or unhappiness or duress among the people in respective factors. Classifying the significant impacting factors for both professional and personal life, they are taken in as input metrics for score analysis.

The fundamental structure to be followed in the system is that a questionnaire shall be available for the respondents to fill, and based on the scores garnered in the two sections, the proposed algorithm model shall analyze the professional and personal score index for the conditions and accordingly reflect the score level determination as to what criteria of conditions exist in the pattern.

3.2 Metrics and Features

The metrics and features that are integral to focusing on the work-life balance scores for the proposed model are

Some of the personal and professional factors that are integral to ensuring the set of indicators are Table 1.

Table 1: The Personal and Professional Factors That Are Integral to Ensuring the Set of Indicators.

Motivation	Happiness to go to work	Job satisfaction	Cope with work pressures	Career growth
Team relationship	Ability to express viewpoints to the team	A fair opportunity for all	Scope for learning new skills	Competency-based scope of works
Flexible work timings	Peer pressure conditions	Consistency in the work practices	Employee engagement	Scope for error

Organizational culture	Addressing personal goals	Commuting to the office	Scope for prioritization	Able to meet family expenses
Family able to cope with job demands	A healthy relationship with spouse and family	Time for personal experiences	Scope for family vacations	The guilt of hiding things from family members

Using the set of metrics, around 45 questions are integral to the proposed solution. The combination of the questions is about indicating both personal scores and the professional score index. All the questions that are integral to the analysis are rated based on the Likert scale, wherein the scaling range is considered 0-5, wherein the 0 remains the lowest rate and the 5 being the highest rate to be answered for a question; The questionnaire and the score determination model proposed for the questionnaire is inspired on the basis of Neal Whitten eLearning course called "Achieving the Elusive Work-Life Balance" and was developed by Neal Whitten in partnership with Velocities [8].

The model proposed in the course mentioned is about developing a system wherein the process is about self-testing conditions and using the solution for improved understanding of the current conditions of work-life balance in a self-assessment.

The approach is to classify the questions into both professional and personal scoring, wherein the score generated finally should have some balance in both the set of scores. Hence, the process of estimating the F1 score fundamental model is applied to the system, wherein the machine learning solutions are evaluated for simple analysis

3.3 Classifiers

The proposed algorithm model shall be trained using the SVM (support vector machine) model. The SVM approach is chosen for the process considering the enormity of classification and the regression challenges which might be encountered in terms of training the data. Predominantly the challenge is used in the case of the classification problems. In the proposed algorithm, the data is plotted for every item in the form of n-dimensional space, in which "n" is the features considered in the model, with a value of every feature being the value for a specific coordinate.

The classification is performed using the hyper-plane wherein it enables in differentiating among the four classes in more effective ways. The four classes that are used for the conditions are Good, Moderate, Average and Poor work-life balance categories. Considering the need for minimizing the error in the training conditions, the following SVM classifier training model is embraced for the application system development

For this type of SVM, training involves the minimization of the error function:

$$\frac{1}{2}w^T w + C\sum_{i=1}^{N}\zeta_i$$

subject to the constraints:

$$y_i(w^T\phi(x_i)+b) \geq 1-\zeta_i and \zeta_i \geq 0, i=1,\ldots,N$$

In the equation above, C is the capacity constant, b is a constant, w is the vector of coefficients, and ζ_i represents parameters for handling non-separable data (inputs).

The index i labels the N training cases. Note that $y \in \pm 1$ represents the class labels and x_i represents the independent variables.

The kernel ϕ is used to transform data from the input (independent) to the feature space. It should be noted that the larger the C, the more the error is penalized.

Thus, C should be chosen with care to avoid overfitting.

3.4 Algorithm

The algorithm used for the proposed model is about

Let be the stress score used for rating and classification with three subcategories for evaluation as

LI – Life Impact score

PI- Profession Impact score

{

{

be the Correlation Co-efficiency P-value of all the parameters (45 parameters) considered from the model.

$$P = \frac{n(\sum xy)-(\sum x)(\sum y)}{\sqrt{[n\sum x^2-(\sum x)^2]-[n\sum y^2-(\sum y)^2]}}$$

Estimation of the correlation values using the equation above in the case of all the score for every parameter indicates the potential listing of higher co-efficiency of which are all the classes that impact the end score.

In the subset scoring, individually all the sub-score (LI_{1-20}) are significant for the system and the value range is

$$LI = \geq 0 \leq 100$$

All the five parameters with scoring range of 0-5 for each of the question

For all the parameters , the n-value

If the $LI \geq 76$, the case can be rated as "Good Personal balance" denoted as GLI

If the $LI \geq 57 \leq 75,$ case is considered for "Moderate Personal Balance" denoted as MLI

If the $LI \geq 39 \leq 56$, the case is considered for "Average Personal Balance" denoted as LLI

If the $Fb \geq 1 \leq 28$, the case is considered for "Poor Personal Balance" denoted as PLI}

{ For the analysis of professional impact score, PI, the model remains the same in terms of estimating the scores for the analysis for 25 features considered integral to the balance.

$$PI = \geq 1 \leq 125$$

Wherein for 25 questions, the score at max value of 5, total can be around 125

For all the parameters $(P_{1.....}P_{25})$, the n-value

$$LI = \sum(P1.....P25),\ where\ in\ Pn \geq 5\ and\ PI \geq 125$$

If the $PI \geq 110$, the case can be rated as "Good Professional balance" denoted as GPI

If the $LI \geq 75 \leq 109$, the case is considered for "Moderate Personal Balance" denoted as MPI

If the $LI \geq 39 \leq 74$, the case is considered for "Average Personal Balance" denoted as LPI

If the $Fb \geq 1 \leq 38$, the case is considered for "Poor Personal Balance" denoted as PPI}

For the estimation of S value, the R- be the cumulative score range (wherein the value does not exceed more than 225)

$$R = \left(\sum(PI + LI)\right)$$

And

$$Rf = \neq 0\ and\ \sim \leq 225$$

If R fulfills the criteria, then the test record is seen as valid and evaluated for score assessment, else the record is reviewed for the invalid record, defined as S_{IV} }

When the input $"S"$ is tested for S-value allocation, the process followed is about

{

Eligibility score

If the S score validation is effective, then the scoring output for task allocation accuracy is estimated as

{

Let $"D"$ be the divisional parameter (count number of parameters marked with $n = "0"$ as rating)

Count of zeros in LI marked as LD, count of zeros in PI marked as PD

$$D = \sum(LD + PD)$$

}

$$S = \sum(LI + PI) / D$$

}

If the S is in the range of 4.0-5.0, the score is considered as Good Work-life Balance

If the S is in the range of 3.0-4.0, the score is considered as Moderate Work-life Balance

If the S is in the range of 2.0-3.0, the score can be perceived as Average work-life balance

If the S in the range of 1.0- 2.0, the score is perceived as a poor work-life balance.

}

3.5 Datasets

The datasets that are considered for the above study are collected using the random survey score collected using the questionnaire-based data inputs. The total number of data records collected for the purpose is 1300, wherein 250 records for each set of two and 350 in one set of training are used in three-set training for the model and the rest of the records are used for the testing purpose.

The Table 2 provides inputs on the quantum of records used for the training purpose and the volume of records that are tested.

Table 2: The Quantum of Records Used for The Training Purpose and The Volume of Records

Record Classification	Volume	Remarks
Total records	1300	
Records used for training	850	Each of the set of training records is 250 in two sets and 350 records in one set
Positive records in 3-sets of training	650	Regarded as positive records
Negative records in 3-sets of training	200	Regarded as negative records
Records used for testing	450	Test data
Positive records for testing	390	Records that are to be classified for a positive category of stress

Negative records for testing	60	Records to be traced by the system as no-stress

3.6 Test Results

Using the data chosen for the training and testing purpose as depicted in section 3.5, the proposed model of an algorithm developed in the system language for input and output analysis is chosen for review. Based on the training data and the SVM classifier, the model is trained in three sets.

Post the training pattern, the model is tested using the test records for detailed analysis of the model in terms of evaluating its performance and accuracy.

It is evident from the test score factors that the model proposed is effective in terms of applying it over the machine learning models. The method of The Neal Whitten Group, when used for detailed analysis using the machine learning models, the scoring system and the functionality of its application over the other models signify potential insights.

For instance, the Table 3 indicates the quantum of performance that is rated on some of the common performance parameters considered for the machine learning models. Among the total records of 450 considered for testing the model, the Figure 1 proposed solution has identified 436 records with more accurate terms.

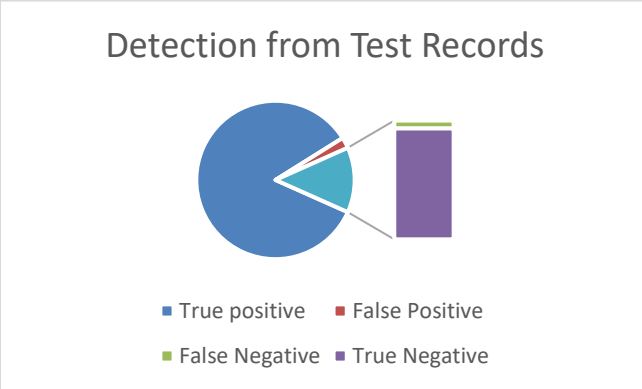

Figure 1: Detection from Test Records

In terms of performance parameters for the model, it is evident that the system is profoundly performing in terms of increased accuracy in the system.

Table 3: The performance score estimated over a distinct set of metrics

Metrics	Performance
Precision	97.44
Recall	98.96
Accuracy	96.89
F1 Score	98.19
Specificity	84.85

The Table 3 performance score estimated over a distinct set of metrics like the precision, recall, accuracy indicates that the model is significant and if trained more effectively for the pragmatic level of implementation across organizational levels, the system shall be reliable. However, the factors that impact the score conditions are about the reliability of the score, which is predominantly in the hands of effective insights provided by the respondent by ensuring accurate rating for the parameters in the questionnaire. If there is any disparity in the scoring by the respondent, the outcome might be influenced.

The other factor for consideration in the system is about the accurate levels of classification that the model could be considered for. Based on the inputs available for the system, it is evident that the model has considerable inputs.

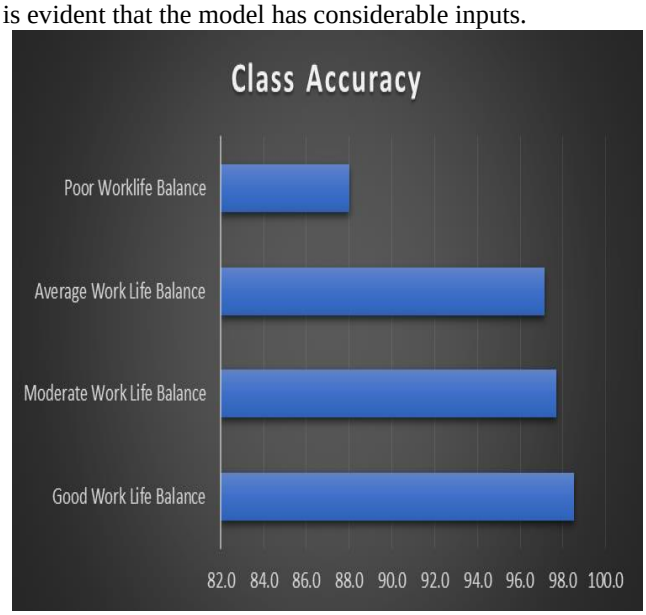

Figure 2: Class Accuracy

The Figure 2 in terms of each class of evaluation, for all the positive records, based on the respective levels of classification, in the case of the poor work-life balance margins, the system could need for emphatical training sets, but whereas in the other class of records, the performance from the system is significant.

IV. CONCLUSION

Work-life balance is one of the key areas wherein significant developments are focused upon by the companies, however, with the advent development of the machine learning models, there are many solutions that were proposed in the domain of work-life balance analysis and improvement models. In this manuscript, a machine learning-based work-life balance analysis scoring pattern is discussed, which is constructed on the lines of Neal Whitten Line model proposed for analysis. The model proposed was trained using the SVM classifier and the model is tested using 450 records. The results that are discussed in section 3.6, reflect on the efficacy of the model and the scope for improvement of the system. If the system has more training sets with contextual inputs, certainly the rate of performance of the system could be improved. As scope for future research, it can be stated that focusing on the individual metrics-based weightage for estimation of scores, can be a significant effort in the domain.

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