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Value group classifier model for ethical decision-making

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ABSTRACT

Decision-makers refer to ethics or moral philosophy during times of ethical dilemma. Dilemmas are situations of inner conflict, which require a methodical approach. Diversity in viewpoints on moral decisions ensures there cannot be a fixed solution for ethical dilemmas as in the case of numerical problems. Existing ethical and sustainable decision models for businesses are not automated because of a lack of a comprehensive list of dilemmas. To resolve this gap, an AI model was trained to classify all dilemmas into three value groups by using a support vector classifier (SVC). The model provided scaffolding to the ethical decision-maker by suggesting relevant human values applicable to the dilemma. The design works on the ethical theory of stakeholder management, which includes sustainable business goals. The study was conducted with 30 students and 30 adults to identify their dilemmas. The dilemma dataset was used to train an ethical decision-support tool, called the value group classification (VGC) model. The model achieved a score of 0.52 on performance. The VGC model overcomes the black-box biases of similar machine-learning models by allowing human autonomy in ethical decisions.

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1. INTRODUCTION

Every religion has the following components (1) metaphysics and concept of God, (2) ways to salvation or liberation, (3) mythology, (4) customs and rituals, and (5) basic ethics. The end objective of all religions is one, the realization of God. Although the ways, mythology, and customs (middle three main components) of religions differ in their practices, all religions agree on basic ethical principles like truth, compassion, and self-control. Ethics are independent of religion, but all religions mention ethics in their teachings.

Normative ethics is the study of ethical behavior and is also known as moral philosophy. It is a collection of multiple theories, which provide a foundation for moral decisions. These are the deontological, consequentialist, and virtue theories. Deontological ethics evaluates morality based on action, while consequentialist theory evaluates morality based on the consequence of the action. The virtue theory, however, uses the intent of the action as its basis of evaluation for morality. Ethics ensure that individual actions do not adversely determine the future of individuals as well as that of society [1].

The three main areas of normative ethics are meta-ethics, applied ethics, and descriptive ethics. Meta-ethics looks at the nature of moral language and what kinds of things can be called ‘good’ or ‘bad’. Applied ethics looks at ethical issues that arise in particular professions, such as medicine or engineering. Descriptive ethics is a branch of empirical sociology that studies people’s opinions about what they think to be morally good or bad behavior.

Value education implies teaching ethical motives, means, and consequences. Usually, a dilemma arises at the time of choosing the means for achieving the motives. These means and motives are subject to evaluation by moral principles/values before being considered ethical. Ethics is an investigation of dilemmas to ensure universal and long-term good, which results in a probabilistic curve representing solutions. Ethical decisions are seen as a trade-off between different moral principles/values, represented in the form of indifference curves. The trade-off or choice of solution depends on the relevance and integrity of the moral question at hand [2].

Religion and ethics draw us closer to harmony. The nature of harmony is inclusivity, empathy, symphony, continuity, self-discipline, and more. Therefore, before making ethical decisions it is important to look at the dilemma from a meta-ethical perspective and identify the stakeholders affected. Identifying stakeholders of the future is not possible in the present. Therefore, a universal approach of dividing all present and future stakeholders into three broad categories based on present-day understanding through laws of physics is adopted. The stakeholders are grouped into three categories non-sentient beings, sentient beings, and abstract situations. These categories ensure protection of environmental resources and humans from exploitation, and social harmony.

To assist the ethical decision-making process, feedback by machines in the form of relevant human values applicable for each stakeholder group, as associated with the dilemma, is provided. It helps the decision-maker define the scope of the problem and draw relevant indifference curves between important values. An ethical decision-making machine learning model, called the value group classification (VGC) model, is developed to provide a set of reference moral values for the dilemma, based on its classification in one of the three value groups. The model is trained using a support vector classifier (SVC). The model ensures human autonomy in decision-making, while using machine learning to support decision analysis.

This paper is divided into four sections. After the introduction, section two performs a literature review of existing ethical decision models. Section three explains the methodology used in this research to find the solution to these gaps. Section four discusses the results and findings and section five concludes with the future scope of work.

2. ETHICAL DECISION MODELS

Existing ethical decision-making frameworks are developed for resolving ethical dilemmas. An ethical dilemma implies a situation when the decision-maker cannot identify the most appropriate response in a situation because of conflicting interests or principles due to a lack of unclear standards or practices prescribed for the situation arising due to its novelty or complexity. These could arise due to conflict in the interests of stakeholders, conflict between applicable standards in different places or for different roles, a trade-off between principles and values, or due to differences in prominent social practices.

Ethical decision-making models were studied and compared to find common gaps, as given in Table 1. The existing models work on internal or external data but do not have any feedback mechanism for the decision-maker. The comparison shows that the models work on processes, but do not lead to self-transformation, Transformation is the positive change from past practices caused by cognitive and affective stimulation. Self-transformation can be triggered through a feedback or response mechanism, using a machine learning model or the computational tool. The feedback in the form of recommended values for decision-making supports the decision-maker in real-time.

These ethical decision-making models lack feedback due to the unavailability of an exhaustive list of dilemmas with their moral equivalence (solution to dilemma) to generate such feedback. In a research conducted to classify statements as moral or immoral, an ETHICS dataset model was built based on all three theories of normative ethics, and the machine was trained to classify the statements as moral or immoral [3]. The results of this classification problem showed an accuracy of less than 75% with the largest training model of ALBERTA-xx large. The model showed sensitivity of the trained model towards framing and emotional conjugation in moral statements, implying a need for greater transparency on training models used and their biases. The study showed that ethical decision models are biased due to machine model biases or diversity in the status of normative ethics.

There are diverse meta-ethical views (viewpoints about the nature, scope, and meaning of moral decisions) on what morals are. These viewpoints are from objectivists, subjectivists, realists, cognitivists, emotivists, and error theorists. Almost all of these diverse viewpoints hold that moral statements express propositions that could be true or false. Each of these propositions relates to one or more moral principles [4]. Therefore, identifying relevant values can facilitate defining the scope of the problem, which is the first step towards finding the solution. A reasonable scope of the problem should involve all stakeholders, affected parties, and environmental concerns.

Table 1. Summary of ethical decision-making models

Ethical decision-making models	Decision process	Emphasis of the Model	Focus
Integrative decision-making model of ethical behavior [5]	Interpret situation to identify dilemma. Determine standards that apply to dilemma and identify possible and probable courses of action. After considering the consequences for each course of action, select an action by weighing competing values, in given context.	Works on external standards and their consequences in the given context	Focuses on external data
Golden circle framework [6]	Answer the why, how, and what in the sequence	Works on self-first and then external information	Focuses on self
ETHICS model [7]	Evaluate the dilemma, think ahead, seek help from consultants and experts, consider available information, calculate risk, Select and action	Works on Self first but puts a lot of emphasis on collecting correct external information	Focuses on external data
Ethical framework for industrial Use [8]	Recognize the ethical issue, gather information, identify proximal and distant stakeholders, identify alternative actions, compare alternative actions, implement action, and monitor outcomes	It is based on the American Psychological Association (APA) Ethical Principles of Psychologists and Code of Conduct. The self-discovery journey is missing since the reference to APA principles and standards is used	Focuses on external data

3. VALUE GROUPS

Identifying the relevant value group for the dilemma at hand requires differentiation between subject and object in the dilemma statement. The characteristics of the subject are its present situation (need wallet) and its belief system (indifference curve preference points). The object is the resource, relationship, or situation causing the conflict or dilemma. The need wallet here defines the person's perceived sufficiency on four parameters; physiological needs, security needs, social needs, and self-actualization needs. The uncertainty of the desired outcome (probability) is defined by the curve between subject's characteristics and the value group predictions.

Identifying relevant human values/value groups/moral principles provides scaffolding for ethical decision-making. Multiple moral solutions for the same dilemma, as shown in Figure 1, are explained using the indifference curves concept of microeconomics. For example, in case of dilemmas about relationships, human values like forgiveness and compassion can be practiced in various degrees. The right trade-off between the two values would depend on the conditions and beliefs of the decision-maker.

The indifference curves are fact-independent and help the decision-maker balance the right package of competing or supplementing principles. If the right set of applicable values is identified, then the decision-maker can build a suitable solution for the dilemma based on his conditions and beliefs.

The VGC model uses an SVC to classify the dilemma stated by the respondent into three value or stakeholder groups. The model does not declare a statement as moral or immoral but rather responds with a relevant value group to help the decision maker reconsider the dilemma in the moral context based on its personalized subject characteristics (needs wallet and belief system). The biases in the previous ETHICS dataset model are resolved in the VGC model by implementing the concept of tradeoff in moral principles using indifference curves [9], which removes the rigid black-box interpretations and allows human autonomy in ethical decision-making.

Stakeholders of each dilemma are grouped as non-sentient, sentient, and abstract; while keeping the environmental and social concerns in sight. Relevant values are derived from meta-ethics, applied ethics (professional standards), and descriptive ethics (social and cultural norms), while meta-ethics values are used in the training set. This grouping of stakeholders allows the creation of awareness and willingness to include the concerns of stakeholders in decision-making [10]. Financial and environmental sustainability of businesses depends on the business strategy and decisions. These decisions are usually data-dependent [11]. Decision tools to facilitate sustainable decisions foster innovation in sustainable solutions [12]. The VGC tool provides holistic guidance on values and principles applicable to the business problem.

According to stakeholder theory [13], the various actors in the firm should be interrelated, to ensure the outcome is socially and economically desirable. In general stakeholder management strategies, the stakeholders are ranked based on their influence or involvement with the decision [14]. This research takes a diversion towards the ethical branch of stakeholder theory [15] by prioritizing only values, thereby ranking all types of stakeholders as equal. Instead of managing the stakeholders, human values are managed to define the scope of the problem.

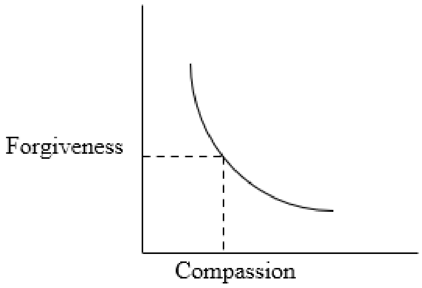

Figure 1. Indifference curve for moral dilemma

4. METHOD

Mixed methods, or triangulation [16] is used in this research. It resulted in combined advantages of quantitative and qualitative methods of research design. Triangulation in research methodology refers to the use of multiple methods or data sources to gain a more comprehensive understanding of a research problem. It enhances the credibility and validity of the findings by cross-verifying data and perspectives [17]. The use of the triangulation method to get different perspectives on the research [18] results in more transparent and explainable results. Theoretical and methodological triangulation methods were used in the research. The choice of probabilistic sampling [19] for collecting primary data on the dilemma justifies the ethical considerations of non-bias. It allows every section of society to have a non-zero chance of inclusion. The interactions with four segments of the sample population were conducted separately. The students, adults, seniors, and elderly were broken into two distinct groups of 30 participants each.

The primary data collection method for the dilemma was a guided group survey. The data collection method of guided group survey (GGS) was developed on the combined principles of focus group discussion (FGD) [20], [21] and survey [22]. While the FGD focuses on social interactions around a context, a survey restricts the responses [23]. In GGS, the initial briefing helped the group understand the expectations and receive guidance while performing introspection about the dilemma in the survey. The responses in GGS are paper or system-based qualitative responses, which encourage reflection through interaction. The method is compared with focus group discussion and survey in Table 2.

Table 2. Comparison of guided group survey with focus group discussion and survey

Principle	Guided group survey	Focus group discussion	Survey
Moderation	Yes	Yes	No
Interactive environment	Yes	Yes	No
Group dynamics	Confidential feedback	Discussion	Personal responses
Open-ended questions	Yes	Yes	Yes
Anonymity	Confidential	Group interaction	Confidential
Context	Introspective and Social	Social	Personal
Number of participants	20	6-12	1 on 1
Flexibility	Allows discussion	Allows discussion	Individual thought
Suitability	Introspective social themes	Expert discussions	Personal insights of experts
Data quality	Qualitative	Qualitative	Quantitative

The digital tool for the guided group survey was developed using Python [24]. It used Excel and HTML visualization for reporting [25]. The digital tool collected primary data and cleaned it for use in machine learning. This tool was trained to work as VGC for ethical decision-making. The digital tool documented the dilemma faced by the users, the group in which they classified the dilemma, and provided a guided process to reconstruct the dilemma, facilitating an ethical decision. The computation tool followed the value-sensitive design (VSD) approach [26] for ethics-by-design. The three stages of VSD namely, empirical investigation, conceptual investigation, and technical investigation are replicated in the three steps of identifying the dilemma group, identifying relevant human values, and recommending the set of values for facilitating the ethical decision using the VGC model [27].

Data processing was performed to make the data suitable for sentiment analysis. The dilemma statements were tokenized to remove stop words and words were lemmatized to their base form to reduce redundancy. The data on dilemmas was used for training the machine to classify dilemmas into three groups using natural language processing.

Sentiment analysis was performed at the aspect level [28] to facilitate multiclass classification [29] using the SVC. It is a type of support vector machine (SVM), that aims to find the hyperplane that best separates classes in the feature space [30]. By maximizing the margin between classes, SVC aims to improve generalization and reduce overfitting. SVC can efficiently handle high-dimensional data and is less prone to overfitting, making it suitable for small datasets. Additionally, SVC can handle high-dimensional data efficiently through the use of kernel functions, which map the input data into a higher-dimensional space where it is easier to separate classes [31].

Considering a small multiclass dataset in this research, SVC was used for training the machine on sentiment analysis [30]. In text classification, each text snippet is represented as a high-dimensional feature vector, where each dimension corresponds to a unique word or n-gram. SVMs are well-suited for working in high-dimensional spaces and can effectively handle the sparse and high-dimensional nature of text data. To train the machine, Sigmoid Kernel is selected, which is represented by:

$$K(x, y) = tanh(\alpha x^T y + c)$$

Here, x and y are the input vectors, α is a scaling parameter, and c is a constant term. The hyperbolic tangent function, $tanh$, squashes the input into the range [-1, 1].

The choice of kernel depends on the type of data [32]. The Sigmoid kernel is used in SVMs when dealing with non-linearly separable data for text classification. The Sigmoid kernel allows for more control over the decision boundary compared to other kernel functions. By adjusting parameters like α and c, one can influence the shape and position of the decision boundary. A distribution of 70/30 is used as a training set for building the classification model.

The small dataset had fewer samples for students and adult women in the non-sentient category. The data drifted towards relationships (sentient) in the case of women, towards objects (non-sentient) in the case of adult men, and towards situations (abstract) in the case of young students. Such imbalances lead to biased model predictions, and limited learning by machines, leading to poor performance. To address these challenges, data augmentation, synthetic data generation, and ensemble learning techniques are utilized to improve the accuracy of the classifier [33]. To build a balanced training dataset with all perceptions (classifier groups), new dilemma statements were introduced for lagging categories in each social group using similar words derived from the word cloud analysis. Similarly, duplicate dilemmas were removed from each social group. This increased the training dataset to 104 dilemmas. The methodology for building SVC is given in Figure 2.

The classifier is a multiclass classifier of level 3 with 2 inputs: dilemma and value group. The classifier trains itself in the first stage by building the characteristics of the model. In the second stage, it predicts the value group for the dilemma, which is used for making recommendations for ethical decision-making.

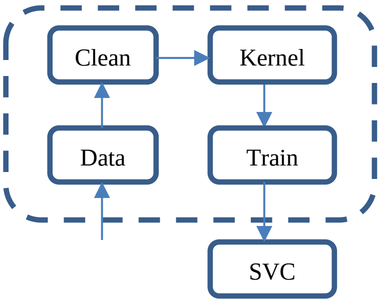

Figure 2. SVC training process

5. RESULTS AND DISCUSSION

The dilemmas were grouped into three categories based on stakeholders and associated ethical value sets are suggested for a given dilemma. The first set of ethical values applies to non-sentient objects on the planet. The second set of ethical values is for sentient beings on the planet. The third category of ethical values relates to abstract or non-physical concepts.

The dilemmas stated by respondents were directly related to the phase of life that they were in. Students had career dilemmas, women had dilemmas related to marital life, men had dilemmas related to social structure and earning opportunities, elderly had health and self-care issues. Based on age groups, four groups of society were identified: students, adults, seniors, and the elderly. The dilemma within these four groups remains similar, but the perception of the dilemma (classifier groups) varies based on the beliefs and conditions of the respondent. The summary of categories and dilemmas of the enhanced dataset is given in Table 3.

The classification problem of the ethical dilemma was solved through SVC. A simple SVC classifier was trained with 83 to 170 support vectors on a small dataset of 104 records. The classifier model was assessed for accuracy, recall, precision, and f1, as given in Table 4. The learning curve of the VGC model is given in Figure 3.

Table 3. Summary of categories and dilemmas in dataset

Society groups	Non-sentient dilemmas	Sentient dilemmas	Abstract dilemmas	Total
Students	18	18	18	54
Adults	12	12	9	33
Seniors	2	2	4	8
Elderly	3	2	4	9

Table 4. VGC results

	Precision	Recall	f1-score	Support
Object	0.36	0.80	0.50	5
Relationship	0.60	0.38	0.46	8
Situation	0.80	0.50	0.62	8
accuracy			0.52	21
Macro avg	0.59	0.56	0.53	21
Weighted avg	0.62	0.52	0.53	21

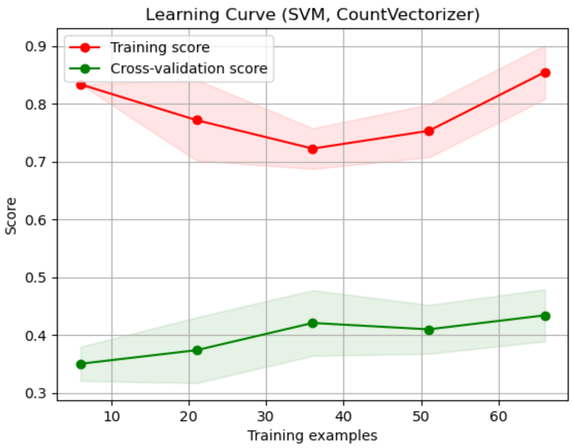

Figure 3. The learning curve of the classification model for values

The Natural Language Toolkit (NLTK) [34] was used to remove stopwords from dilemmas and using lemmatization, the words were converted into their base form. The filtered sentences were used for creating a wordcloud for each of the categories. Figure 4 shows the distinguishing keywords of the three classification groups, which were used for further training the model in classification.

Figure 4. WordCloud for three classification groups (object, relationships, and abstract)

The VGC model recommends relevant human values applicable to the ethical decision. The suggestions of Kshama, Anasuya, and daya in Figure 5 are applicable in the case of relationships or sentient beings. This recommendation by VGC is based on the probability distributions of value groups' predictions for outcomes. The classification of dilemmas is done in three categories (non-sentient, sentient, and abstract) rather than as binary (ethical or non-ethical statements). Since each dilemma can have multiple outcomes based on the conditions and beliefs of the subject (decision-maker), the model only suggests relevant values and not ethical statements. These value group recommendations are used for defining the scope of the problem, which is dependent on the stakeholder values and expected outcome.

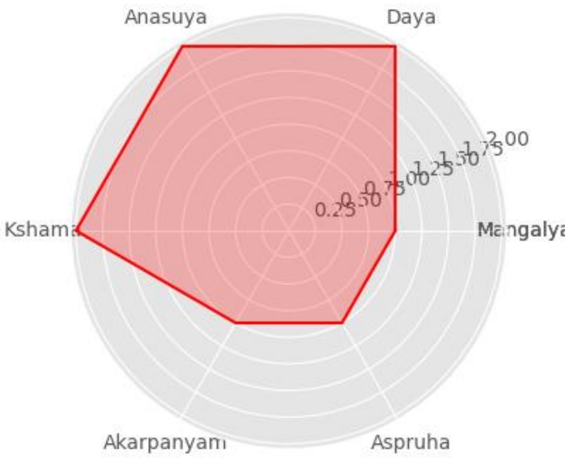

Figure 5. Feedback for value recommendation according to classification groups

6. CONCLUSION

Existing ethical decision-making models describe processes for decision-making, but cannot give a numerically accurate solution for a dilemma. A dilemma is caused by conflicting values or interests. Since the conflict happens between a few selected values, we lose the vision of the larger picture and try to fix the immediate problem or conflict, leading to myopic decisions.

An AI model to suggest relevant human values to ethical decision-makers is developed to classify all dilemmas into three categories non-sentient, sentient, and abstract. The VGC model recommends all relevant human and environmentally sustainable values applicable to the dilemma and facilitates the decision-maker in defining the scope of the problem. The decision-makers trade-off between the conflicting values for a balanced decision. The model showed a performance score of 0.52 and will be trained with larger datasets on bigger training models to improve classification problems.

A decision can be made better with feedback. Rather than evaluating a decision as right or wrong, a set of reference moral values can be suggested as scaffolding to the decision-maker for ethical decision-making. Since dilemmas are themselves ambiguous statements, classifying them as ethical or unethical based on predictive uncertainty is not feasible. Moreover, human autonomy in the case of ethical decisions should not be compromised by automation.

The limitation of the research is the limited number of classes. A dilemma can be associated with more than one class in the real world and the associated human values change accordingly. As the data increases over time, machines can be trained to identify related human values directly from dilemma statements. Data processing in the form of stop word removal and lemmatization increases the accuracy of the model but reduces the number of support vectors used for classifying data. As the amount of data increases and with the use of advanced models of classification, the need for lemmatization would also reduce.

VGC is part of the Ethical Intelligence model that can be enhanced for behavior training and automated as a part of future research to suggest ethical decision-making alternatives to decision-makers. In addition to decision-making tools, there is a wide scope for taxonomy and ontology for organizing human knowledge to derive professional values. The present paper lays the foundation for the development of Ethical Intelligence and offers prospects for expansion through the incorporation of ensemble algorithms and Data Science, fostering further research in this domain.

Ethical approval: All procedures performed in human participant studies were under the Ethical Guidelines for Research Involving Human Participants and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.
Informed consent: Informed consent was obtained from all individual participants included in the study
Availability of data and material: Data used for research can be made available for reference.

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