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SuperHyperSoft Set for Selection Strategies for Achieving Human Rights in Artificial Intelligence through Civil Public Interest Litigation

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Abstract: Making sure AI technologies respect and uphold human rights is crucial as AI gets more and more integrated into social structures. AI systems that are unethical or discriminatory may be challenged in court through civil public interest litigation (CPIL). To assess and choose strategic options for realizing human rights through CPIL in the AI domain, this study creates a SuperHyperSoft Set model with multicriteria decision making (MCDM) approach. We evaluate eight workable options and identify 14 criteria that represent ethical, legal, technological, and social aspects. The SuperHyperSoft Set is used to deal with different criteria values. ORESTE is used to rank the alternatives. The suggested model assists decision-makers in choosing the best advocacy and litigation tactics that are in line with AI deployment's human rights safeguards.

Keywords: SuperHyperSoft Set; MCDM; Human Rights; Artificial Intelligence; Civil Public Interest Litigation.

1. Introduction

Healthcare, finance, education, and governance are just a few of the industries that have been profoundly touched by the exponential expansion of artificial intelligence (AI). Although efficiency and creativity are promised by these developments, they also bring up important human rights issues like responsibility, nondiscrimination, privacy, and due process[1], [2]. Civil public interest litigation, or CPIL, has become a potent tool for addressing systemic problems that impact the general welfare. When it comes to AI, CPIL can fight against algorithmic prejudice, excessive surveillance, and rights abuses brought on by automated decision-making systems. Choosing the right legal and strategic frameworks is still difficult, even with CPIL's expanding involvement. These frameworks need to strike a balance between social justice goals, legal accuracy, and technological knowledge, especially in a sector as complicated and developing as artificial intelligence[3], [4].

When dealing with multi-attribute decision-making situations where parameter subsets differ in granularity, SuperHyperSoft set theory offers a solid mathematical framework. It is especially well-suited to the complex analyses needed to evaluate litigation tactics that take social, legal, and ethical factors into account[5], [6].

To assess selection strategies for realizing human rights in AI through CPIL, this research suggests a SuperHyperSoft set-based decision-making model. It presents 14 standards that cover the societal, technical, and legal effects of possible strategies[7], [8].

A variety of legal and strategic actions, ranging from algorithmic audits to constitutional litigation, are represented by the eight choices that have been outlined. To ascertain each alternative's efficacy and applicability in various situations, it is compared to the criteria.

The assessment process helps human rights advocates, legal experts, and politicians find the best approaches for addressing certain human rights issues in AI applications. The suggested approach improves the decision-making process for protecting human rights through strategic litigation and lobbying in the AI ecosystem by integrating SuperHyperSoft set theory, providing a sophisticated, multifaceted analysis[9], [10].

A significant interdisciplinary technique used in many different sectors to support intricate decision-making procedures incorporating numerous factors is multi-criteria decision-making (MCDM)[11], [12]. In contrast to conventional decision-making, which usually considers a single criterion, MCDM assesses options according to a variety of frequently incompatible criteria to identify the best course of action. MCDM helps decision-makers prioritize options and attain optimal results by evaluating influential aspects (criteria) and their relative relevance (weight)[13], [14].

Since its inception in the late 1950s, MCDM has developed into a strong field that facilitates efficient navigation of complex decision spaces1. The exact definition of the problem and the determination of the decision criteria are the first two crucial elements in the MCDM process. Then, using techniques like pairwise comparisons or rating systems, each criterion is given weight according to its relative worth. After that, a thorough list of workable options is created. Each of these options is given a score determined on how well it performs when compared to the choice criteria. Following evaluation, each alternative's overall score is calculated by adding the values for each criterion[15], [16].

For this, a variety of aggregation techniques can be used. Sensitivity analysis is used to examine the effects of altering the weights of the criteria and the evaluation scores of the alternatives to guarantee the decision-making process's robustness. Ultimately, the alternative with the greatest total score is chosen after a decision is made based on the total scores. A balanced compromise or ideal solution that successfully meets the various criteria involved in the decision-making process is made possible by this methodical approach[17], [18].

The HyperSoft Set (2018), IndetermSoft Set (2022), IndetermHyperSoft Set (2022), SuperHyperSoft Set, TreeSoft Set (2022), and ForestSoft Set (2024) are the six new varieties of Soft Sets that Smarandache announced[19], [20], [21].

2. SuperHyperSoft Set

By mapping power set combinations of several values to subsets of a universal set, SuperHyperSoft Sets further generalize the idea and increase the usefulness of HyperSoft Sets. This higher-order method is an effective tool for modeling complex systems because it enables multidimensional decision-making and captures complicated interrelationships among characteristics[21], [22].

Let U be a universal set and P(U) presents the power set of U. Let set attributes such as $a_1, a_2, \dots, a_n; n \geq 1$. Every criterion has different values A_i

$$A_i \cap A_j = \emptyset \ and \ i \neq j \tag{1}$$

$p(A_i)$ is the power set of A_i. The cartesian product of the power set of criteria values is:

$$C = p(A_i) \times p(A_2) \times \dots p(A_n) \tag{2}$$

The SuperHyperSoft Set can be defined as[23], [24]:

$$F: C \rightarrow p(U) \tag{3}$$

$$(F, C) = \{(x, F(x)) | x \in C, F(x) \in P(U)\} \tag{4}$$

We show the steps of the ORESTE method under the SuperHyperSoft set to rank the alternatives based on a set of criteria.

Create the decision matrix.

Based on the opinions of experts, the decision matrix is built such as:

$$X = \begin{pmatrix} x_{11} & \cdots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{mn} \end{pmatrix} \tag{5}$$

Combine the decision matrix into a single matrix. The criteria weights are computed using the average method.

Compute the position matrix by ranking the alternatives.

Create the block distance.

$$S(0, A_{ij}) = \gamma x_{ij}(\gamma) + (1 - \gamma) x_j \tag{6}$$

Where $0 < \gamma < 1$

Order the alternatives based on the total rank of alternatives such as:

$$R(A_i) = \sum_{j=1}^{n} R(A_{ij}) \quad (7)$$

3. Results

This study discusses the results of the SuperHyperSoft Set model for ranking the alternatives based on the MCDM method. This study uses 14 criteria and eight alternatives.

The criteria with values are:

I. Transparency of AI Systems {High, Medium}
II. Legal Enforceability {Strong, Weak}
III. Stakeholder Inclusivity {Government, NGOs, Technologists, Civil Society}
IV. Ethical Accountability {Present, Absent}
V. Impact on Marginalized Communities {High Impact, Medium Impact, Low Impact}
VI. Technological Feasibility {Feasible, Partially Feasible}
VII. Cost-effectiveness {Low Cost, Medium Cost, High Cost}
VIII. Scalability of Litigation Effort {Scalable, Limited, Non-scalable}
IX. Precedent-setting Potential {Strong Potential, Some Potential, No Potential}
X. Public Awareness and Support {Widespread, Moderate, Minimal}
XI. Policy Influence {Direct Influence, Indirect Influence, None}
XII. Risk Mitigation for Plaintiffs {High, Medium, Low}
XIII. Expert Collaboration Opportunities {High Collaboration, Moderate, None}
XIV. Interdisciplinary Approach Strength {Strong, Moderate, Weak}

The alternatives are:

I. Constitutional Litigation against Biased Algorithms
II. Class-Action Lawsuits on Data Privacy Violations
III. Judicial Review of AI in Public Sector Decision-Making
IV. Strategic Partnerships for Algorithmic Audits
V. Public Interest Petitions on Predictive Policing
VI. Legislative Advocacy through CPIL
VII. Filing Cases for Algorithmic Discrimination in Employment
VIII. AI Ethical Standard Implementation via Legal Channels

Eq. (5) is used to create the decision matrix between the criteria and alternatives. The decision matrix is combined to obtain the criteria weights by the average method such as:

C1 has 0.0682– Represents how open and explainable AI models are to courts and the public, crucial for accountability.

C2 0.0721– Reflects the strength of the legal framework supporting AI-related human rights cases in court.

C3 0.0779– Emphasizes the participation of civil society, tech experts, and marginalized groups in litigation planning and execution.

C4 0.0718– Captures the extent to which ethical AI practices are recognized and enforced within legal boundaries.

C5 0.0672– Indicates how effectively strategies protect vulnerable populations affected by AI deployment.

C6 0.0644– Assesses whether the proposed litigation strategies can technically address the AI systems in question.

C7 0.0595– Measures how financially viable and resource-efficient each litigation strategy is for sustained implementation.

C8 0.0699– Describes the potential to apply the legal strategy across multiple similar cases or jurisdictions.

C9 0.0747– Indicates the likelihood that a case could create significant legal precedents for future AI-related human rights claims.

C10 0.0820– Reflects the level of social mobilization and public backing for the cause, which can influence litigation outcomes.

C11 0.0714– Represents the ability of the legal strategy to trigger or influence AI policy reforms at governmental or institutional levels.

C12 0.0772– Weighs how well the strategy protects litigants from legal, financial, and personal risks.

C13 0.0720– Assesses the involvement of legal, technical, and ethical experts in building strong multidisciplinary cases.

C14 0.0717– Captures how comprehensively the strategy blends law, technology, and ethics in tackling AI-related injustices.

We apply the steps of the ORESTE methodology based on the SuperHyperSoft set. We have indeterminacy in the first two criteria so, we divide the ORESTE method into four sets such as:

I. Set 1: {High}, {Strong}, {Civil Society}, {Present}, {High Impact}, {Feasible}, {Medium Cost}, {Scalable}, {Strong Potential, {Moderate}, {Direct Influence}, {High}, {High Collaboration},{Strong}.
II. Set 2: {High}, {Weak}, {Civil Society}, {Present}, {High Impact}, {Feasible}, {Medium Cost}, {Scalable}, {Strong Potential, {Moderate}, {Direct Influence}, {High}, {High Collaboration},{Strong}.

III. Set 3: {Medium}, {Strong}, {Civil Society}, {Present}, {High Impact}, {Feasible}, {Medium Cost}, {Scalable}, {Strong Potential, {Moderate}, {Direct Influence}, {High}, {High Collaboration},{Strong}.

IV. Set 4: {Medium}, {Weak}, {Civil Society}, {Present}, {High Impact}, {Feasible}, {Medium Cost}, {Scalable}, {Strong Potential, {Moderate}, {Direct Influence}, {High}, {High Collaboration},{Strong}.

In Set 1.

We compute the position matrix by ranking the alternatives. We create the block distance using Eq. (6) as shown in Fig 1. We order the alternatives based on the total rank of alternatives using eq. (7) as shown on Fig 2. The ranks of alternatives are shown in Fig 3.

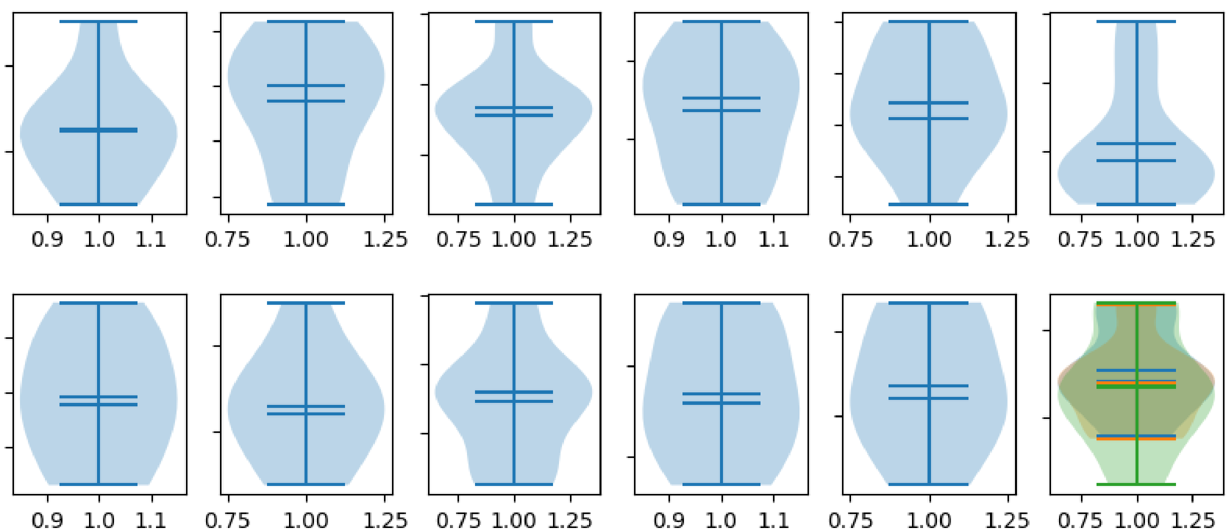

Fig 1. The block distance.

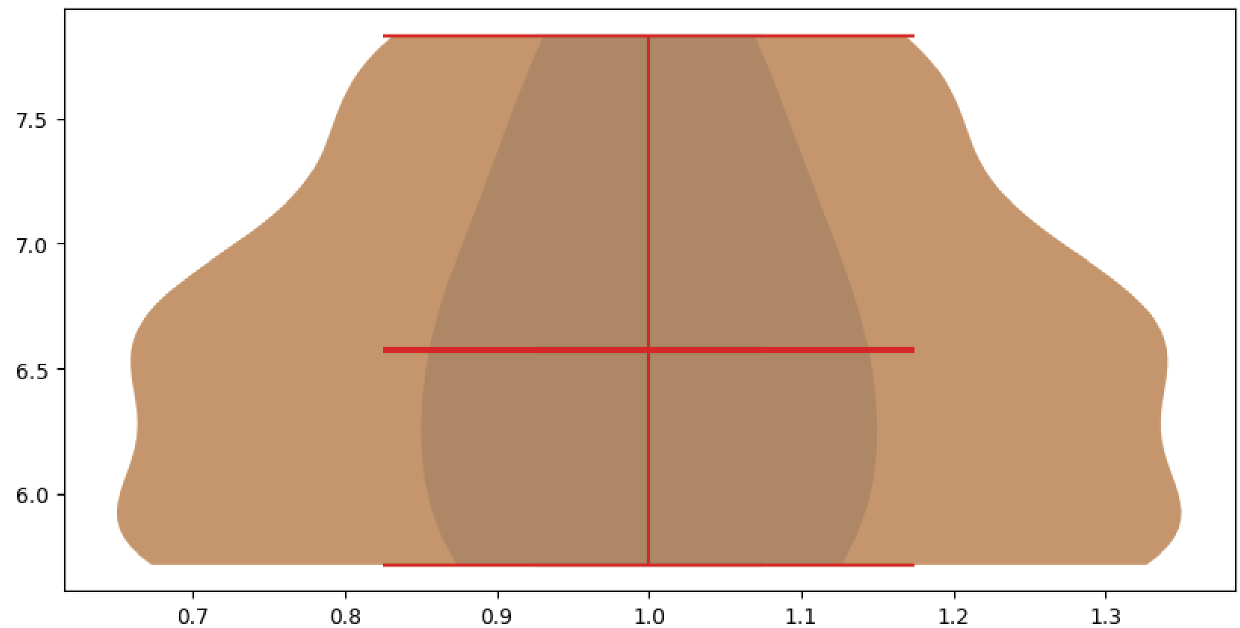

Fig 2. The total distance.

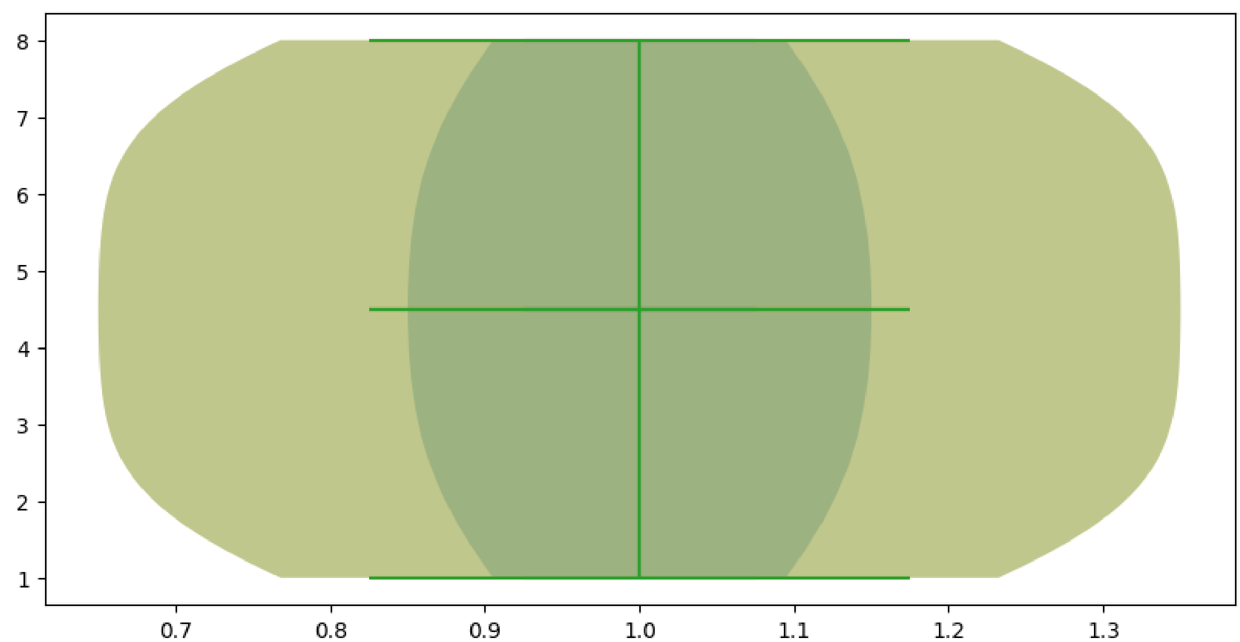

Fig 3. The ranks of alternatives.

In Set 2.

We compute the position matrix by ranking the alternatives. We create the block distance using Eq. (6) as shown in Fig 4. We order the alternatives based on the total rank of alternatives using eq. (7) as shown on Fig 5. The ranks of alternatives are shown in Fig 6.

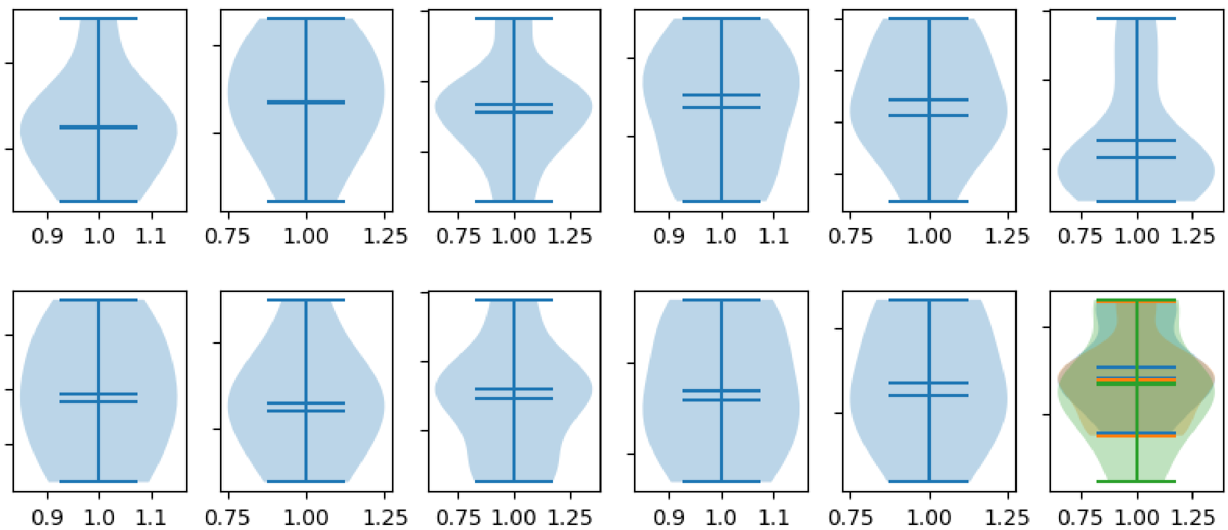

Fig 4. The block distance.

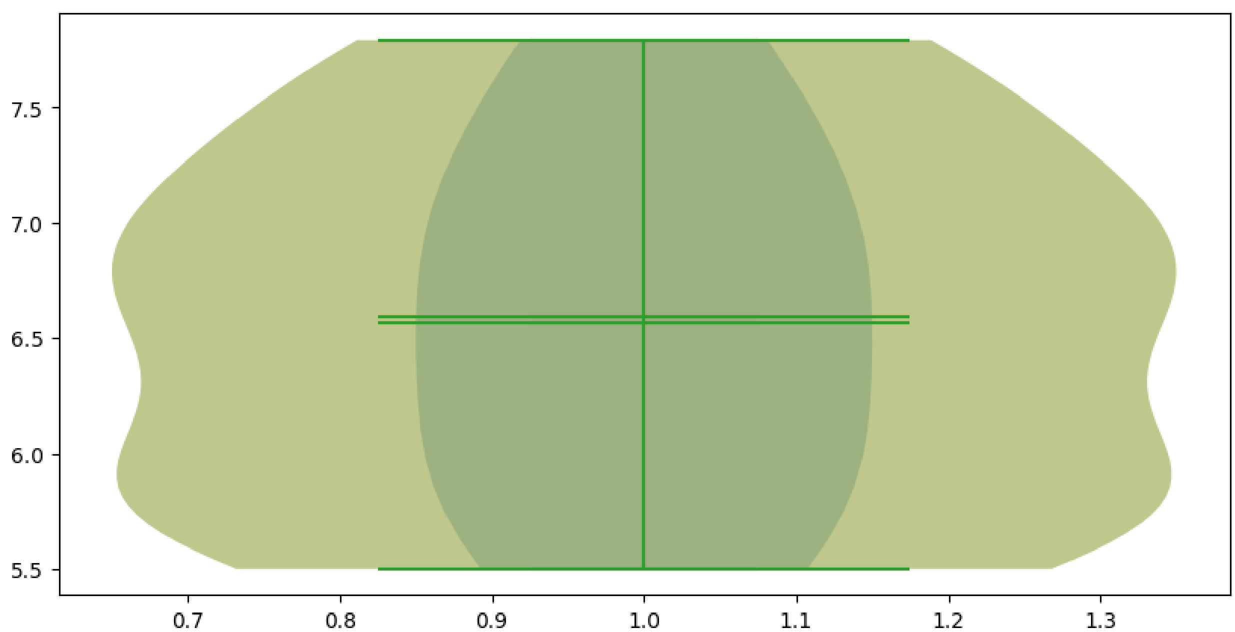

Fig 5. The total distance.

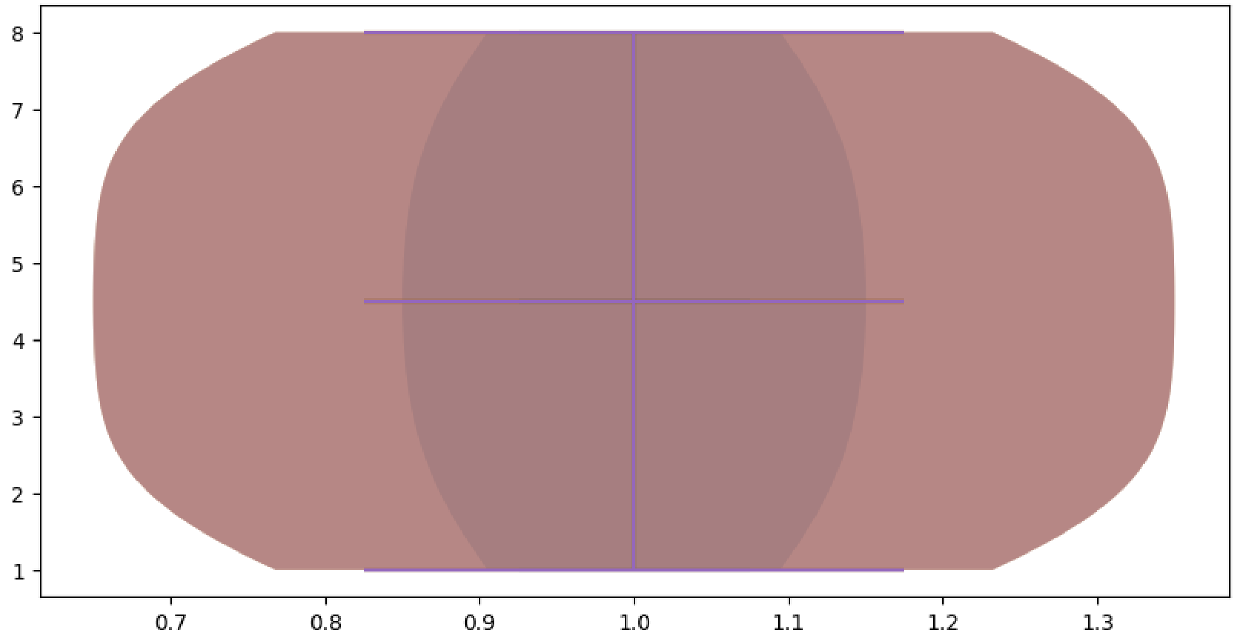

Fig 6. The ranks of alternatives.

In Set 3.

We compute the position matrix by ranking the alternatives. We create the block distance using Eq. (6) as shown in Fig 7. We order the alternatives based on the total rank of alternatives using eq. (7) as shown on Fig 8. The ranks of alternatives are shown in Fig 9.

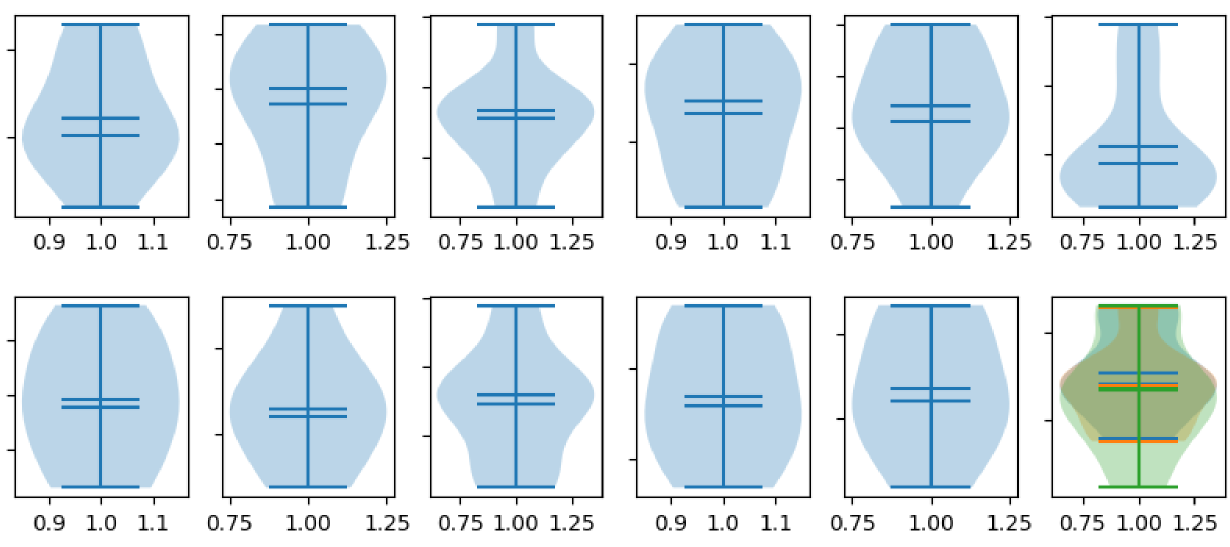

Fig 7. The block distance.

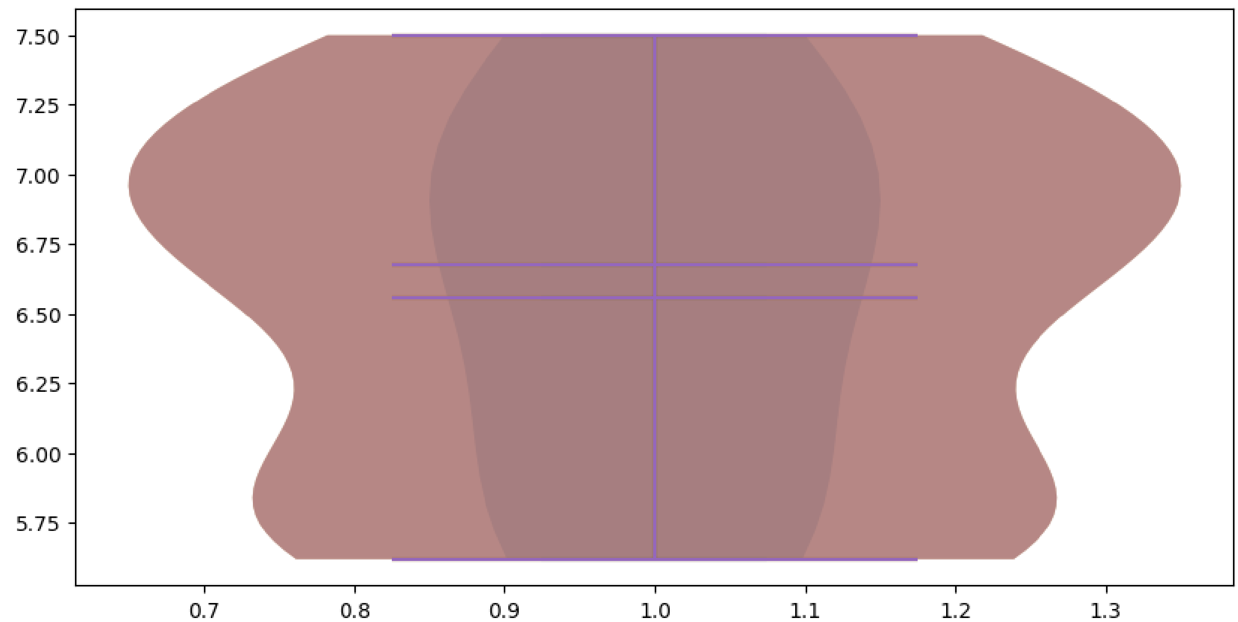

Fig 8. The total distance.

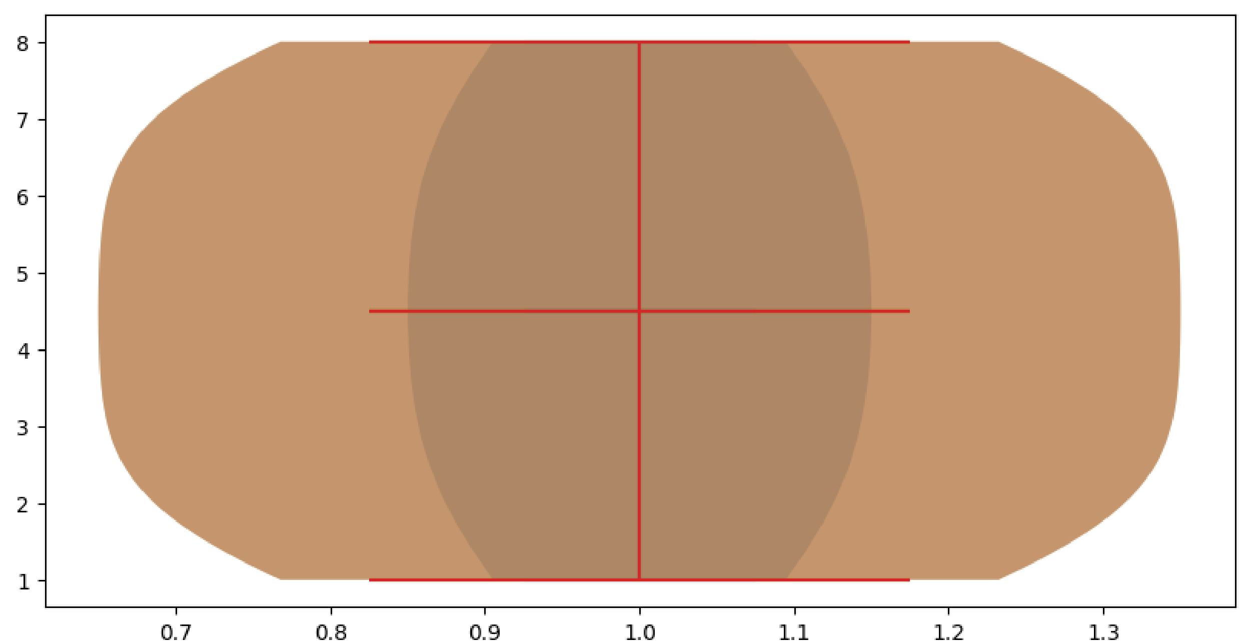

Fig 9. The ranks of alternatives.

In Set 4.

We compute the position matrix by ranking the alternatives. We create the block distance using Eq. (6) as shown in Fig 10. We order the alternatives based on the total rank of alternatives using eq. (7) as shown on Fig 11. The ranks of alternatives are shown in Fig 12.

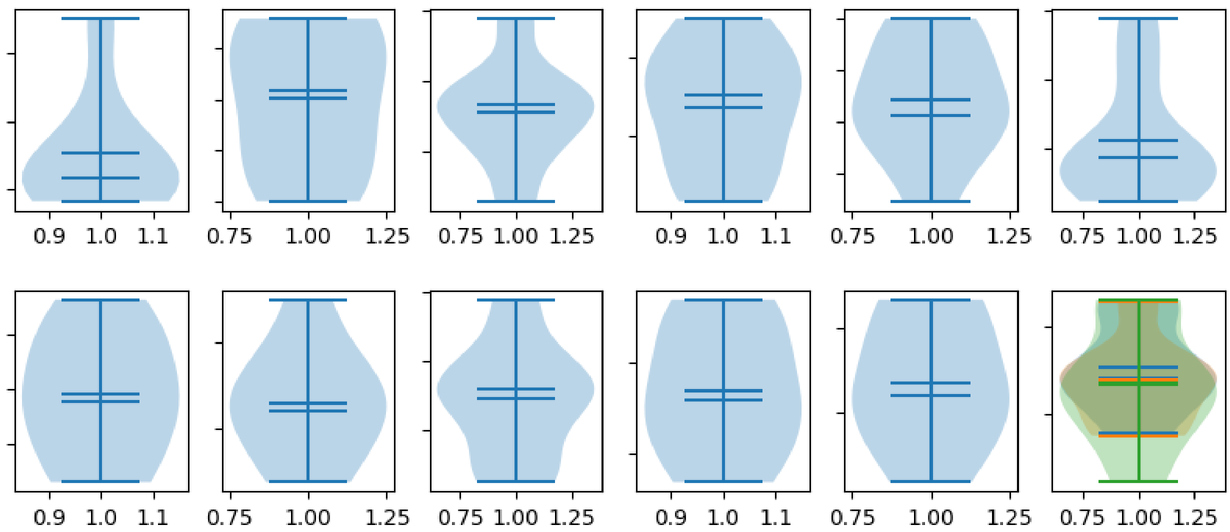

Fig 10. The block distance.

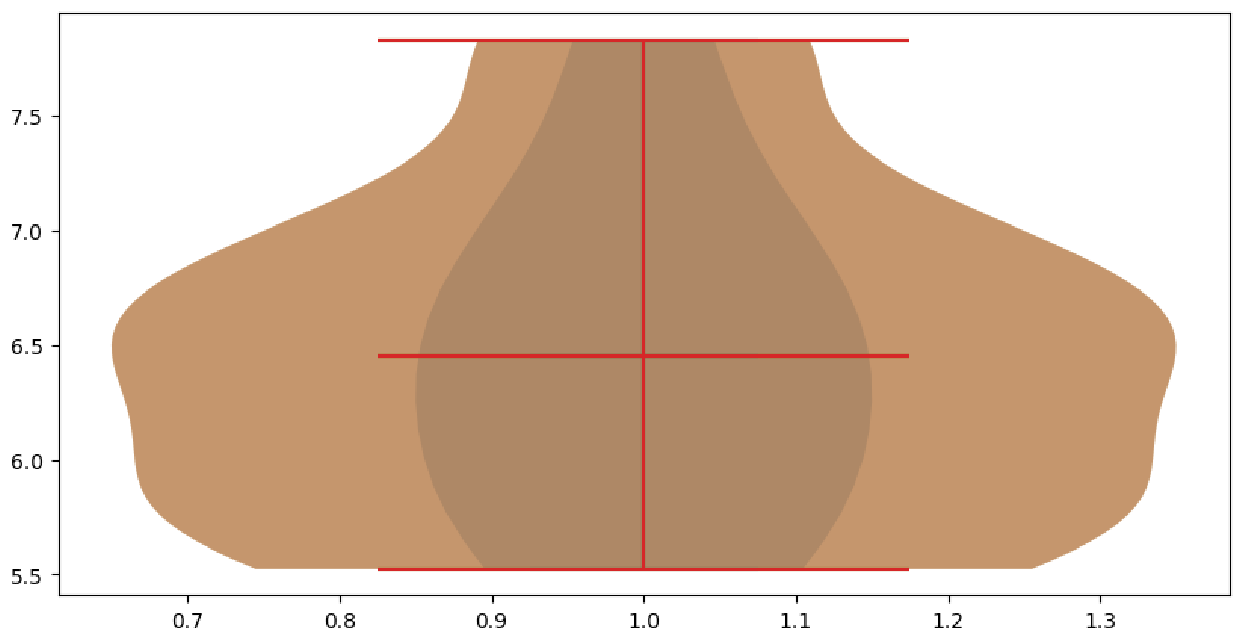

Fig 11. The total distance.

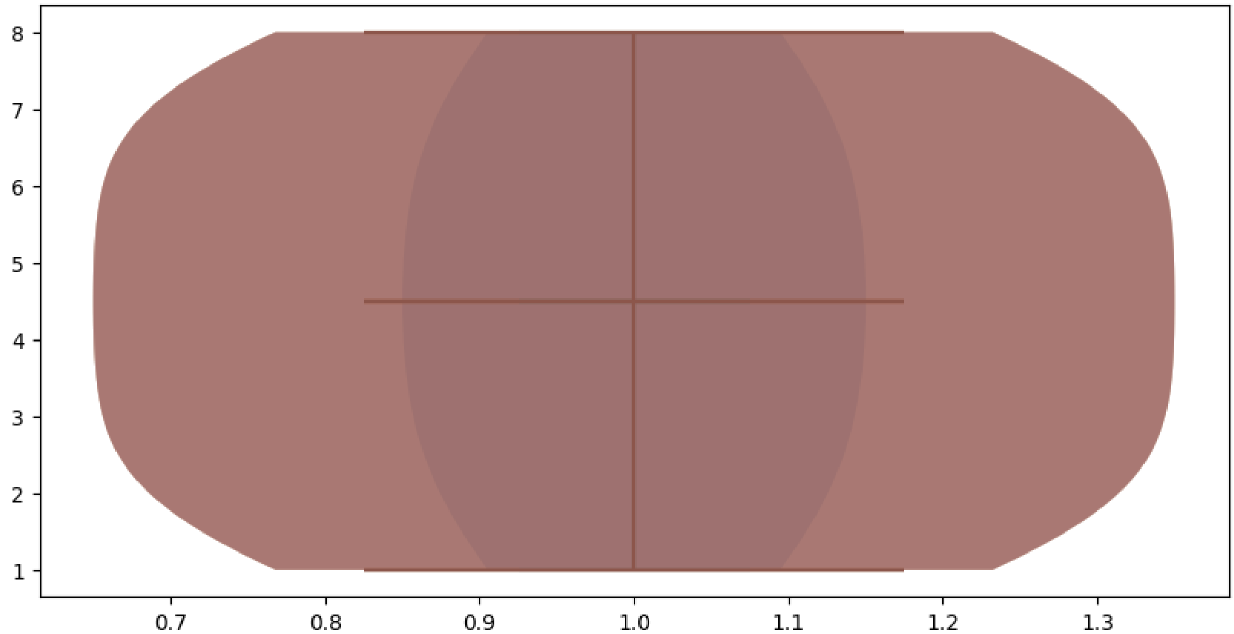

Fig 12. The ranks of alternatives.

- A1 and A4 dominate, frequently scoring 1st or 2nd. These represent strong strategic options in most evaluation dimensions.
- A5 is highly consistent in the top 3, showing strong reliability.
- A2 and A3 stay between 4th and 5th ranks, showing moderate effectiveness but not outperforming consistently.
- A6, A7, and A8 maintain static and low ranks (6th, 7th, and 8th respectively) across all sets, indicating limited utility or poor strategic alignment.

Alternative	Lowest Rank	Highest Rank	Repetitive Rank	Ranks
A1	1 (Set 2, Set 4)	2 (Set 1, Set 3)	2 (2 times)	Consistently high-performing and reliable.
A2	4 (Set 2, Set 3)	5 (Set 1, Set 4)	4 (2 times), 5 (2 times)	Mid-range performers with moderate consistency.
A3	4 (Set 1, Set 4)	5 (Set 2, Set 3)	5 (2 times), 4 (2 times)	Stable but not a top performer, stays mid-rank.
A4	1 (Set 1, Set 3)	3 (Set 2, Set 4)	1 (2 times), 3 (2 times)	Alternates between top and slightly lower, strong overall.
A5	2 (Set 2, Set 4)	3 (Set 1, Set 3)	3 (2 times), 2 (2 times)	Very stable, always ranked 2nd or 3rd.
A6	6 (All Sets)	6 (All Sets)	6 (4 times)	Perfectly consistent, but consistently low.
A7	7 (All Sets)	7 (All Sets)	7 (4 times)	Another low and repetitive performer.
A8	8 (All Sets)	8 (All Sets)	8 (4 times)	Lowest performer in every scenario

5. Conclusions

Protecting human rights in the rapidly developing field of artificial intelligence requires proactive, strategic involvement through civil public interest lawsuits. This study shows how selection strategies based on multiple, frequently competing criteria can be efficiently analyzed and prioritized using SuperHyperSoft set theory. A thorough assessment process that complies with human rights principles and practical viability is ensured by the integration of legal, ethical, technological, and social considerations. We used the MCDM methodology to deal with different criteria and alternatives. The ORESTE method is an MCDM method used to rank alternatives. The SuperHyperSoft set is used to deal with different criteria values. The suggested framework gives interested parties a methodical, flexible paradigm for making wise choices in the ever-evolving field of AI law.

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