A New Approach for Applying Intelligent Systems in Biomedical Research

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ABSTRACT:

The Abstract should be self-contained, avoiding abbreviations, with clear presentation of the research problem, e.g., in this paper a new idea on using intelligent systems to enhance biomedical research in the direction of osteoma classification is presented. The new results should be clearly presented (preferably in a quantitative manner) versus previous research methods, e.g., simulation study and experimental work found that AI can enhance the accuracy of osteoma classification by 35% as compared to state-of-the art methods.

Regarding the paper title, it should be concise but expressive, clarifying the contribution of the paper.

KEYWORDS:
Artificial Intelligence, Machine Learning, Biomedical Engineering, Medical Instruments, Medical Diagnosis.

I. INTRODUCTION

In this section, the Authors should lead the readers from the general research area to their specific contribution, and to convince the audience that the work is necessary to fill in a research gap in addressing a specific problem.
The Introduction should include a brief description of the research area and briefly define essential terms and concepts, with a typical length of 10-15% of the paper length. The current state of the art should be discussed with a summary of key existing methods, theories, or results, citing the relevant (especially, recent) literature, with clear presentation of the research gap, but avoiding exhaustive survey or details, which belong to "Background and Related Work". The contributions of this work should be stated explicitly at the end of this section, along with a short paragraph on paper organisation (e.g., starting with "the remainder of the paper is organised as follows …").
Review papers should adhere to the PRISMA guidelines [1].

II. RELATED WORK

In this section, the Authors should clarify how this paper fits into, differs from, and improves upon existing research. There should be a structured argument to position the contribution versus existing works that are directly relevant to the problem at hand (as defined in the Abstract and Section-I). Existing papers should be grouped by approach or methodology, but not by year (e.g., model-based versus data-driven methods, analytical versus numerical techniques, classical versus deep-learning-based approaches, …).
Dividing such a review into sub-sections can be necessary, e.g.,

II- A. Model-Based Methods:

This sub-section handles approaches that rely on explicit mathematical or physical models.

II- B. Data-Driven Methods:

This sub-section handles approaches that rely on learning patterns from data rather than explicit mathematical models.

Strengths and limitations of existing works should be discussed to prepare the ground for the contribution(s) of the submitted paper that would address these research gap(s).

III. BACKGROUND

In this section, the Authors should provide a concise technical and conceptual foundation to help the reader understand the rest of the paper. Highly technical papers should include mathematical notation used throughout the paper, list of abbreviations, and list of symbols. References include tutorials, standard textbooks, or survey papers to clarify the foundational concepts and theories.
Literature results that are critical to the current work can be placed in an Appendix.

IV. METHODOLOGY (or: SYSTEM ANALYSIS)

This section is the technical core of the submitted paper, in which the Authors explain clearly the proposed idea or system and how exactly it works, with sufficient details that the readers would be able to understand, analyse, and replicate the work as a reference for future research.
Explicit assumptions and constraints should be stated, with links to the Background section.
In technical papers, a mathematical model is presented, along with system and data-flow diagrams. All equations and within-text symbols should be edited and numbered professionally using and equation editor (e.g., MS-Equation Editor), e.g., two Gaussian distributions with means m and n respectively but sharing the same variance σ^2 are given by:

$$y_1(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-m}{\sigma}\right)^2} \quad \ldots (1)$$

$$y_2(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}(\frac{x-n}{\sigma})^2} \quad \dots (2)$$

Please use boldface, non-italic mathematical symbols for vectors and matrices, while non-bold, italic symbols are used for scalars. Functions (e.g., sin) should not be typeset in bold or italic.
Focus should be on main ideas, while lengthy proofs could be deferred to an Appendix.
For the work to be reproducible, a step-by-step description or a pseudocode is presented, with full description of parameters and their roles.
Trade-offs in the system performance should be considered.

Algorithm 1: Multiplying a matrix by a scalar

1. Input: Matrix **M**, scalar β.
2. Calculate the product: $\mathbf{C} = \beta \cdot \mathbf{M}$.
3. Display the output **C**.
4. Stop.

V. RESULTS AND DISCUSSIONS

This section includes the results reached via experimental work, simulation study, or both, with discussions to demonstrate the value of these findings versus the results found earlier by existing methods.
Comparisons and ablation studies are necessary to clarify the effectiveness of any proposed modifications or extensions of existing techniques.
Performance criteria and evaluation metrics should be clearly defined. Results should be analyzed and defended using clear links to the Methodology (or System Analysis) Section. Figures and tables should be used for presentation of results.
Table caption should be expressive, and its parameters should be clearly defined.
Figures should have expressive captions with clear and well-defined axes, as in Figure 1 and Table 1.
Limitations and failure cases should be reported.
The software, hardware, and datasets used in the system implementation should all be declared.

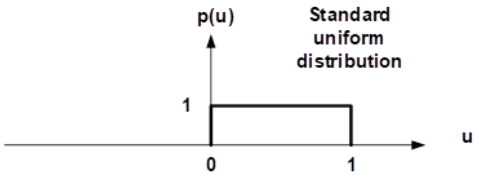

Figure 1: The standard uniform probability density function [2].

Table 1: Performance Comparison using the dataset in [3].

Method	% Accuracy
Existing	93%
Proposed	94%

VI. CONCLUSIONS

This is the final statement of the submitted paper.
It includes a brief re-statement of the problem, a summary of the main contributions, and a statement of the main results or findings, with an explanation how these results can make an advancement in the field.
Assumptions, weaknesses, and limitations should also be stated.
It is good to add a statement on future work.

VII. ACKNOWLEDGEMENTS

This section is to recognise the non-author contributions and support that made the proposed research possible, e.g., funding sources, infrastructural support, data-collection assistance, Language or editing assistance.

VIII. AUTHOR CONTRIBUTIONS

This is to clarify individual roles of Authors in this work. This is necessary to prevent honorary or ghost authorship. The roles include:

- Conceptualization (idea formulation, research goals),
- Methodology (method or model development), Software (coding and implementation),
- Validation (verification, testing),
- Formal analysis (mathematical or statistical analysis),
- Investigation (experiments or data collection),
- Resources (data, tools, or materials),
- Data Curation (data processing and management),
- Writing (original draft), Review & Editing (of original draft),
- Visualization (figures and diagrams),
- Supervision,
- Project Administration,
- Funding Acquisition.

If Authors contributed equally, then the statement “Authors contributed equally to this work” would be sufficient.

IX. DATA & CODE AVAILABILITY STATEMENT

To enable reproducibility and reference-value of the submitted paper, the Authors should clarify how the data and codes used in the presented work can be accessed by readers (either using public repositories or via a private contact with the Authors).

X. REFERENCES

This section follows the IEEE referencing style, but without abbreviations (unless supportive). Note that the citation style is different for each publication category (book, book-chapter, journal article, conference paper, …), as in the following examples.

[1] PRISMA Website, accessed on 10th January 2026. https://www.prisma-statement.org/

[2] G. G. Roussas. *Introduction to Probability*, 2nd ed. Academic Press, 2013.

[3] P. Leavey et al., Osteosarcoma dataset. The Cancer Imaging Archive, 2019. https://doi.org/10.7937/tcia.2019.bvhjhdas

[4] A. B. Author, "Title of a journal paper," *Full name of the Journal*, vol. x, no. x, pp. xxx-xxx, year, doi: 10.1202.XXX.1234567.

[5] G. O. Researcher, "Title of a book-chapter," in *Title of the Book*, 2nd ed., J. Johns (Editor), New York, NY, USA: McGraw-Hill, 1991, pp. 33–66.

[6] C.-K. Vinn, *Full title of a Book*. New York, NY, USA: McGraw-Hill, 1999, pp. 133–166.

[7] D. B. First and J. R. Second, "Title of a conference paper," in *Proceedings of IEEE International Telecommunication Networks and Applications Conference (ITNAC)*, Melbourne, Australia, 2021, pp. 585–590.

Appendix – A: Pythagorean Theorem

This theorem has been used in Section III to support the theoretical background of this work. It can be summarized as follows.

Appendix – B: Proof of Theorem 1

In Section IV, Theorem 1 has been used to support Algorithm 1. The proof of this theorem will be presented in this appendix as follows.