CricXpert: A Hybrid Approach Combining Facial and Spatio-Temporal Gait Analysis For Enhanced Fielder Recognition with LLM-Based Statistic Generation

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# I. INTRODUCTION

In the fast-paced and highly competitive realm of Twenty20 Internationals (T20i) cricket, accurate and timely player recognition is paramount for enhancing both game analytics and viewer experience. This is particularly true in the final overs of a match, where critical decisions are made and the performance of fielders can significantly influence outcomes. However, recognizing players in such dynamic environments presents a host of challenges. These include variable lighting conditions, occlusions caused by other players, and distant camera angles, which complicate the recognition process. Traditional computer vision techniques, such as Convolutional Neural Networks (CNNs), have made significant strides in recognizing objects and features in images [1]. Yet, their performance in complex real-world environments, such as sports fields, remains inconsistent, particularly when dealing with smaller datasets or noisy data [2], [3].

In the context of cricket player recognition, deep learning models like ResNet and Vision Transformers have been employed for spatial feature extraction due to their success in capturing complex image patterns [4], [5]. However, despite their power, these models are prone to overfitting and lack the robustness needed for real-world sports analytics, where the variability of the data is high [6]. Recent research has explored hybrid models that combine deep learning feature extractors with traditional machine learning classifiers, such as Support Vector Machines (SVM) and K-Nearest Neighbors (KNN), to enhance model performance [7], [8]. For example, **Özyurt (2020)** proposed an efficient deep feature selection technique using fused deep learning architectures, highlighting the advantages of integrating deep learning with machine learning classifiers to improve performance in complex environments [7]. Additionally, **Kibriya et al. (2021)** explored similar hybrid approaches for brain tumor classification using CNN-SVM models, which demonstrated the effectiveness of such combinations for medical image classification tasks [8], [9].

This paper addresses these challenges by enhancing the performance of spatial recognition models through a novel fusion of deep learning feature extractors with traditional machine learning classifiers. Specifically, we utilize **ResNet50** as the primary feature extractor and combine it with **Support Vector Machines (SVM)** and **K-Nearest Neighbors (KNN)** classifiers in a stacking ensemble. Stacking ensembles have been shown to improve model accuracy and robustness by leveraging the strengths of different models to correct each other’s errors [4], [5]. By integrating machine learning classifiers with deep learning models, we mitigate overfitting and improve generalizability, particularly under challenging conditions such as low-light environments and occlusions.

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* The word “data” is plural, not singular.
* The subscript for the permeability of vacuum *µ*0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.
* In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
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* There is no period after the “et” in the Latin abbreviation

“et al.”.

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An excellent style manual for science writers is [7].

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*a) Positioning Figures and Tables:* Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation “Fig. 1”, even at the beginning of a sentence.

### TABLE I

TABLE TYPE STYLES

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aSample of a Table footnote.

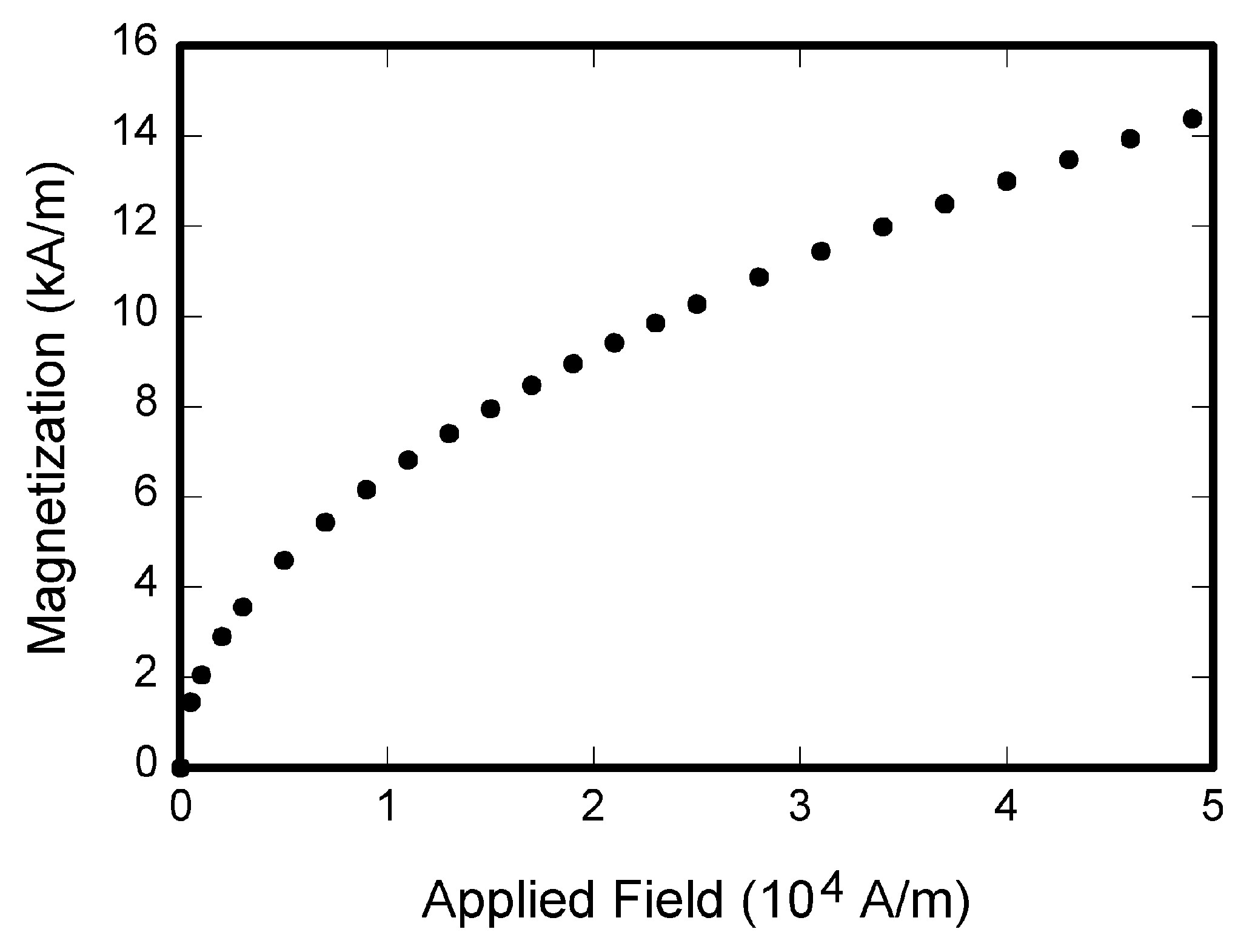


Fig. 1. Example of a figure caption.

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### ACKNOWLEDGMENT

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression “one of us (R. B. G.) thanks *...*”. Instead, try “R. B. G. thanks*...*”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

### REFERENCES

Please number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use “Ref. [3]” or “reference [3]” except at the beginning of a sentence: “Reference [3] was the first *...*”

Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the abstract or reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors’ names; do not use “et al.”. Papers that have not been published, even if they have been submitted for publication, should be cited as “unpublished” [4]. Papers that have been accepted for publication should be cited as “in press” [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

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