Aplicação da Lógica Fuzzy na Previsão do Campeonato Brasileiro de Futebol de 2024

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***Abstract*—Esse artigo apresenta uma abordagem matemática para a previsão dos resultados do Campeonato Brasileiro de Futebol de 2024 utilizando lógica fuzzy. A lógica fuzzy é uma técnica que lida com a incerteza e imprevisão, aplicando modelos e prevendo resultados dos confrontos entre times a partir de diferentes variáveis. O estudo envolve a coleta e a análise de dados de partidas dos anos anteriores disponíveis na internet, fornecendo dados sobre condições dos times, atributos dos jogadores e informações sobre cada partida. Através da definição de funções de pertinência e regras, é criado um sistema de inferência fuzzy, sendo possível gerar um resultado de cada partida, e por fim, o resultado do campeonato. Os resultados obtidos demonstram a eficácia da lógica fuzzy na previsão de cenários, sendo uma ferramenta útil para usos científicos e comerciais.**

***Index Terms*—Campeonato, Futebol, Fuzzificação, Modelagem, Previsão, Sistema, Esporte, Lógica**

I. Introdução

Desde os primórdios da civilização, os seres humanos possuem um desejo intrínseco de competir, característica impulsionada por uma combinação de diversos fatores. Biologicamente, a competição pode ser atrelada à busca por sobrevivência e à reprodução, pois os indivíduos competiam por recursos escassos e por parceiros sexuais. Psicologicamente, competir é uma maneira de obter reconhecimentos dos outros indivíduos do grupo e ser aceito socialmente, além de validar habilidades. Por fim, a competição pode ser considerada uma característica que molda o comportamentos dos indivíduos e influencia as estruturas sociais e econômicas da nossa socidade

Com o passar dos anos, as apostas esportivas crescem cada vez mais no Brasil, com casas de apostas presentes como patrocinadoras de praticamente todos as equipes da série A do Campeonato Brasileiro de 2024. Porém, as apostas não são um fenômeno recente, existindo registros que remontam à antiguidade, quando indivíduos de civilizações greco-romanas apostavam em resultados dos Jogos Olímpicos e corridas de bigas. Ao longo dos séculos houveram mudanças na maneira que as apostas eram feitas, sendo incorporadas em diferentes esportes e eventos. No século XIX, o Reino Unido ficou conhecido por estabelecer uma base de como as apostas são feitas nos dias atuais, onde haviam casas que geravam os valores de retorno para os diferentes tipos de apostas disponíveis. Atualmente, o crescimento do uso da internet possibilitou maior facilidade para que usuários pudessem realizar os seus palpites sem precisar sair de casa.

Com o grande crescimento do poder computacional e avanços tecnológicos, foram desenvolvidos diversos algoritmos que tentam prever os resultados de partidas e campeonatos. Ferramente de machine learning e análise de grandes bases de dados, ou big data, permitem criar modelos com alta precisão. Uma destas diversas ferramentas é a lógica fuzzy, particularmente eficaz em modelar casos complexos e subjetivos, diferentes da lógica binária. Este artigo explora o uso dessa ferramenta na tentativa de prever os resultados do Campeonato Brasileiro de 2024, que com o tempo, pode provar ou não a eficácia do modelo.

II. Objetivos

Esse artigo tem como principais objetivos desenvolver um modelo de previsão baseado em lógica fuzzy para prever os resultados do Campeonato Brasileiro de 2024 utilizando dados disponibilizados na internet, analisar a eficácia desse modelo comparando com os últimos campeonatos, identificar as variáveis mais interessantes de serem utilizadas, validar o modelo através de testes, alterando variáveis, comparando os resultados e explorando diferentes cenários.

A modelagem desse problema pode ser dividida em quatro partes, sendo o tratamento dos dados utilizados através da busca por variáveis mais relevantes e combinação de dados de diferentes anos através de ferramentas estatísticas, criação das funções de pertinência a partir dos dados gerados, criação das regras com base nas variáveis e funções de pertinência e simulação e computação dos resultados.

III. Metodologia

Before you begin to format your paper, first write and save the content as a separate text file. Complete all content and organizational editing before formatting. Please note sections **??**–IV-C below for more information on proofreading, spelling and grammar.

Keep your text and graphic files separate until after the text has been formatted and styled. Do not number text heads—LaTeX will do that for you.

IV. Resultados

- Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary

units (in parentheses). An exception would be the use of English units as identifiers in trade, such as "3.5-inch disk drive".
- Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.
- Do not mix complete spellings and abbreviations of units: "Wb/m^2" or "webers per square meter", not "webers/m^2". Spell out units when they appear in text: ". . . a few henries", not ". . . a few H".
- Use a zero before decimal points: "0.25", not ".25". Use "cm^3", not "cc".)

A. Equations

Number equations consecutively. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in:

$$a + b = \gamma \tag{1}$$

Be sure that the symbols in your equation have been defined before or immediately following the equation. Use "(1)", not "Eq. (1)" or "equation (1)", except at the beginning of a sentence: "Equation (1) is . . ."

B. LaTeX-Specific Advice

Please use "soft" (e.g., `\eqref{Eq}`) cross references instead of "hard" references (e.g., `(1)`). That will make it possible to combine sections, add equations, or change the order of figures or citations without having to go through the file line by line.

Please don't use the `{eqnarray}` equation environment. Use `{align}` or `{IEEEeqnarray}` instead. The `{eqnarray}` environment leaves unsightly spaces around relation symbols.

Please note that the `{subequations}` environment in LaTeX will increment the main equation counter even when there are no equation numbers displayed. If you forget that, you might write an article in which the equation numbers skip from (17) to (20), causing the copy editors to wonder if you've discovered a new method of counting.

BibTeX does not work by magic. It doesn't get the bibliographic data from thin air but from .bib files. If you use BibTeX to produce a bibliography you must send the .bib files.

LaTeX can't read your mind. If you assign the same label to a subsubsection and a table, you might find that Table I has been cross referenced as Table IV-B3.

LaTeX does not have precognitive abilities. If you put a `\label` command before the command that updates the counter it's supposed to be using, the label will pick up the last counter to be cross referenced instead. In particular, a `\label` command should not go before the caption of a figure or a table.

Do not use `\nonumber` inside the `{array}` environment. It will not stop equation numbers inside `{array}` (there won't be any anyway) and it might stop a wanted equation number in the surrounding equation.

C. Some Common Mistakes

- 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.)
- A graph within a graph is an "inset", not an "insert". The word alternatively is preferred to the word "alternately" (unless you really mean something that alternates).
- Do not use the word "essentially" to mean "approximately" or "effectively".
- In your paper title, if the words "that uses" can accurately replace the word "using", capitalize the "u"; if not, keep using lower-cased.
- Be aware of the different meanings of the homophones "affect" and "effect", "complement" and "compliment", "discreet" and "discrete", "principal" and "principle".
- Do not confuse "imply" and "infer".
- The prefix "non" is not a word; it should be joined to the word it modifies, usually without a hyphen.
- There is no period after the "et" in the Latin abbreviation "et al.".
- The abbreviation "i.e." means "that is", and the abbreviation "e.g." means "for example".

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

D. Authors and Affiliations

The class file is designed for, but not limited to, six authors. A minimum of one author is required for all conference articles. Author names should be listed starting from left to right and then moving down to the next line. This is the author sequence that will be used in future citations and by indexing services. Names should not be listed in columns nor group by affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization).

E. Identify the Headings

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include Acknowledgments and References and, for these, the correct style to use is "Heading 5". Use "figure caption" for your Figure captions, and "table head" for your table title. Run-in heads, such as "Abstract", will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced.

F. Figures and Tables

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

Table Head	**Table Column Head**		
	Table column subhead	***Subhead***	***Subhead***
copy	More table copy[a]		

[a]Sample of a Table footnote.

Fig. 1. Example of a figure caption.

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity "Magnetization", or "Magnetization, M", not just "M". If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write "Magnetization (A/m)" or "Magnetization {A[m(1)]}", not just "A/m". Do not label axes with a ratio of quantities and units. For example, write "Temperature (K)", not "Temperature/K".

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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