Department: Head

Exploring CNN-based Architectures in Vietnamese Traditional Music Genre Classification

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***Abstract*—This study looks into how well Convolutional Neural Networks (CNNs) classify traditional music genres from Vietnam. Using mel-spectrograms and various feature combinations, we examine three architecture designs: DenseNet, LRCNN, and Late Fusion CNN. Two datasets are used to assess the models: a curated Vietnamese traditional music dataset and the small-scale FMA dataset. Based on the Vietnamese traditional music dataset, our findings show that the Late Fusion CNN architecture achieved the maximum accuracy (???%), indicating the usefulness of merging multi-modal information for genre classification. This paper explores effective and precise CNN-based solutions for Vietnamese traditional music genre classification, which advances music information retrieval (MIR) systems.**

THE INTRODUCTION should provide background information (including relevant references) and should indicate the purpose of the manuscript. Cite relevant work by others, including research outside your company. Place your work in perspective by referring to other research papers. Inclusion of statements at the end of the introduction regarding the organization of the manuscript can be helpful to the reader. A key component of music information retrieval (MIR) systems is music genre classification, which makes it possible for users to browse, search, and recommend music with ease. Because Convolutional Neural Networks (CNNs) can learn highly discriminative features from audio spectrograms, they have become excellent tools for automatic music genre classification. Nevertheless, the majority of previous study ignores the

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unique opportunities and difficulties that Vietnamese traditional music presents in favor of Western music genres. Vietnamese music is characterized by a wide range of instruments, styles, and regional variances, which frequently complicates the definition of genres. By examining how several CNN architectures perform for the genre classification of Vietnamese traditional music, this article seeks to close this gap. Three intriguing architectures are compared:

- DenseNet: By encouraging feature reuse and information flow, a dense connection pattern may increase classification accuracy.
- LRCNN: This architecture, which could be advantageous for genres with unique rhythmic patterns, combines Long Short-Term Memory (LSTM) networks to capture temporal correlations within spectrograms.
- Late Fusion CNN: In order to potentially increase discriminating, this method combines the independent predictions of several spectrograms that represent various musical qualities (such as mel and chroma).

We use two datasets to assess these designs' performance:

- FMA: A publicly accessible, small-scale dataset with a variety of musical genres.
- Vietnamese Traditional Music Dataset: This dataset, which includes a variety of Vietnamese traditional music genres, was carefully selected and assembled for this study.

SECTIONS

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Scalar *variables* and *physical constants* should be italicized, and a bold (non-italics) font should be used for **vectors** and **matrices**. Do not italicize subscripts unless they are variables.

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bered consecutively, with equation numbers in parentheses and flush right.

Be sure the symbols in your equation have been defined before the equation appears or immediately following. Please refer to "Equation (1)," not "Eq. (1)" or "equation (1)."

Punctuate display equations when they are part of the sentence preceding it, as in $a^2 + b^2 = c^2$. In addition, if the text following the equation flows logically as a part of the display equation,

$$A = \pi r^2. \tag{1}$$

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- *Style for bulleted lists*—This is the style that should be used for bulleted lists.
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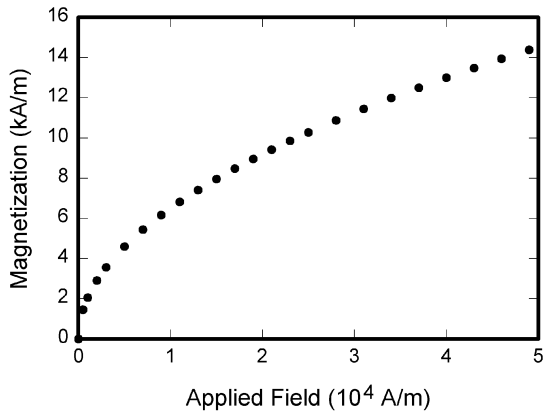

Figure 1. Note that "Figure" is spelled out. There is a period after the figure number, followed by one space. It is good practice to briefly explain the significance of the figure in the caption. (Used, with permission, from [4].)

Table 1. Units for magnetic properties.

Symbol	Quantity	Conversion from Gaussian and CGS EMU to SI[a]
Φ	Magnetic flux	1 Mx $\rightarrow 10^{-8}$ Wb $= 10^{-8}$ V · s
B	Magnetic flux density, magnetic induction	1 G $\rightarrow 10^{-4}$ T $= 10^{-4}$ Wb/m^2
H	Magnetic field strength	1 Oe $\rightarrow 10^{-3}/(4\pi)$ A/m
m	Magnetic moment	1 erg/G $=$ 1 emu $\rightarrow 10^{-3}$ A · m^2 $= 10^{-3}$ J/T
M	Magnetization	1 erg/(G · cm^3) $=$ 1 emu/cm^3 $\rightarrow 10^{-3}$ A/m
$4\pi M$	Magnetization	1 G $\rightarrow 10^{-3}/(4\pi)$ A/m
σ	Specific magnetization	1 erg/(G · g) $=$ 1 emu/g $\rightarrow$ 1 A · m^2/kg
j	Magnetic dipole moment	1 erg/G $=$ 1 emu $\rightarrow 4\pi \times 10^{-10}$ Wb · m
J	Magnetic polarization	1 erg/(G · cm^3) $=$ 1 emu/cm^3 $\rightarrow 4\pi \times 10^{-4}$ T
χ, κ	Susceptibility	$1 \rightarrow 4\pi$
χ_ρ	Mass susceptibility	1 cm^3/g $\rightarrow 4\pi \times 10^{-3}$ m^3/kg
μ	Permeability	$1 \rightarrow 4\pi \times 10^{-7}$ H/m $= 4\pi \times 10^{-7}$ Wb/(A · m)
μ_r	Relative permeability	$\mu \rightarrow \mu_r$
w, W	Energy density	1 erg/cm^3 $\rightarrow 10^{-1}$ J/m^3
N, D	Demagnetizing factor	$1 \rightarrow 1/(4\pi)$

Vertical lines are optional in tables. Statements that serve as captions for the entire table do not need footnote letters.
[a]*Gaussian units are the same as cg emu for magnetostatics; Mx = maxwell, G = gauss, Oe = oersted; Wb = weber, V = volt, s = second, T = tesla, m = meter, A = ampere, J = joule, kg = kilogram, H = henry.*

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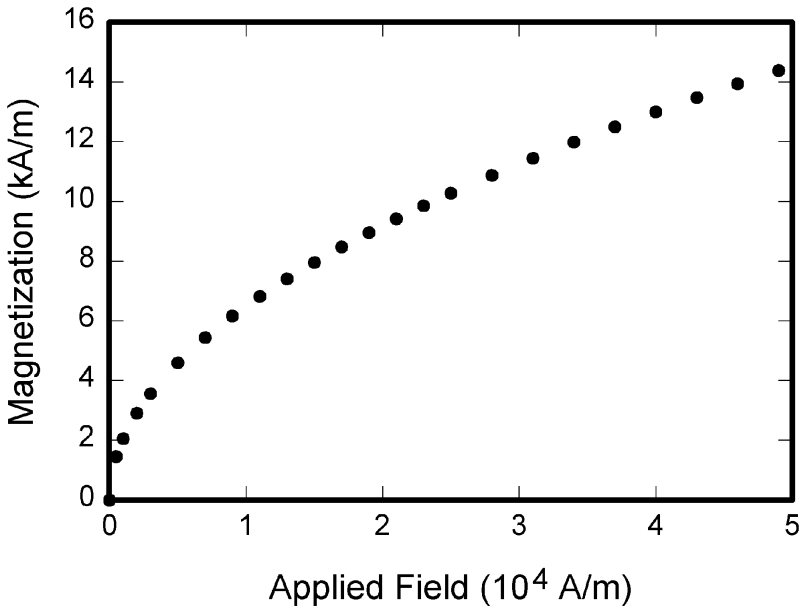

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If multiple appendices are required, they should labeled "Appendix A," "Appendix B," etc. They appear before the "Acknowledgment" or the "References" section.

Acknowledgment

The "Acknowledgment" (no's) section appears immediately after the conclusion. If applicable, this is where you indicate funding for the work. The preferred spelling of the word "acknowledgment" in American English is without an "e" after the "g." Avoid expressions such as "One of us (S.B.A.) would like to thank . . .." Instead, write "We thank . . .." Sponsor and financial support acknowledgments are included in the acknowledgment section. For example: This work was supported in part by the U.S. Department of Commerce under Grant BS123456 (sponsor and financial support acknowledgment goes here). Researchers that contributed information or assistance to the article should also be acknowledged in this section. Also, if corresponding authorship is noted in your paper it will be placed in the acknowledgment section. Note that the acknowledgment section is placed at the end of the paper before the reference section.

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CONCLUSION

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ACKNOWLEDGMENTS

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