

of false positives, and subsequently prepare such a system for live real-time use.

Various opportunities exist to extend the results of our research. A possible extension of this paper concerns the combination of two or more of the discussed methods. As explained in earlier sections, it is extremely difficult to construct class boundaries due to the nature of the pattern note positions. This is another prospective extension of this work. Notably, the present study was conducted considering exclusively monophonic music signals. The possible application of the methods presented here on polyphonic single track music, monophonic multi track music, and polyphonic multi track music would also render this study much more useful to real world applications. Furthermore, this work applied the proposed methods on a mobile workstation computer, whereas smart musical instruments rely on embedded systems. In future work we plan to investigate how to manage the computational complexity and make it possible to put the methods developed for musical pattern recognition into actual smart instruments, as well as to devise novel IoMusT applications based on them.

IX. CONCLUSIONS

In this paper we investigated musical patterns detection in real-time, a topic that has not yet received adequate attention in the field of Music Information Retrieval, and which is relevant to several IoMusT applications. Specifically, we considered the case of a monophonic streams of MIDI notes as produced in real-time by a smart musical instrument. For this purpose, we presented a representation mechanism to denote musical notes as a single column matrix, whose contents correspond to three key attributes of each musical note - pitch, amplitude and duration. Based on such representation, we compared the most prominent candidate methods based on neural networks and one deterministic method. Numerical results show the accuracy of each method, and allow us to characterize the trade-offs among those methods.

We believe that this study is among the first in the area of real-time musical pattern detection for IoMusT applications, and several developments are needed to address the numerous research directions and potentialities.

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