Technology for the detection of piano fingering: tests and applications

Duration   : 6 months
Team   : Loki (Inria Lille – Nord Europe & CRIStAL)
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As part of their practice, pianists (professional or amateur) need to annotate the scores they are working on with information on how they will interpret them. In particular, they have to note the fingerings they will apply - i.e. which finger plays which note on which key on the keyboard. It is a long and tedious job, as it cannot be automated. Although there are conventional playing techniques and fingerings, the pianist's technical level, his or her particularities and personal interpretation will result in varying fingerings from one person to another. Pianists must therefore, during their working session, play the piece, determine the "right" fingerings and constantly go back and forth to annotate them on the score, before to possibly transcribe them on a digital score using dedicated software. The purpose of this project is to conduct robustness and reliability tests on a first hardware and software prototype that allows the automatic and real-time detection of fingerings performed on a piano. These tests will improve the system, the objective being to make it easier for pianists to annotate fingerings on their scores and to help practice these fingerings as part of piano practice or teaching. Based on this prototype, interactions and visualization techniques for these applications can also be studied during the internship.

Description

Some solutions have already been proposed and some prototypes have been made for such a system, but they often have constraints and issues that are not satisfactory for their daily use and for their popularization: lack of robustness, constraining instrumentation of the piano and/or the pianist. Based on a finger recognition system for touch surfaces and computer keyboards designed and developed in the Loki team [1], we have developed a first prototype that is less intrusive and very promising.

The objective of this internship is now to test this prototype, position and evaluate it against the state of the art, and improve it in order to achieve the necessary reliability and robustness requires for the design of usable and efficient interactive applications that can be used by pianists. The steps of the work are therefore:

- review of the state-of-the-art of existing systems for the recognition of pianist's fingerings and characterization and classification of technologies that could potentially be used to build such a system (cameras, motion capture, motion sensors, etc.) in a robust and non-intrusive manner

- positioning of the existing prototype in relation to this state-of-the-art. Design (hardware, software and protocol) and conduct of studies to assess the reliability of the prototype and compare it to the technologies characterized previously

- based on the results of these studies, propose hardware and software ("recognizer") improvements for the prototype

- first proposal of interactive tools based on this system: scores annotation, real-time visualization of fingerings during performance for practice or learning, etc.

This work is conducted in collaboration with Hugues Leclère, pianist and piano teacher at the CRR of Paris, who will participate in the studies (with his students, if necessary) and contribute his expertise to the finalization of the prototype as well as to the design of the interactive applications.

Candidate

The candidate must demonstrate a strong interest in HCI, and programming skills for various input and capture devices; knowledge of electronics and an interest in and practice of music (piano in particular) are a plus. He or she will have to demonstrate technical and conceptual creativity.

References

[1] D. Masson, A. Goguey, S. Malacria and G. Casiez, "WhichFingers: Identifying Fingers on Touch Surfaces and Keyboards using Vibration Sensors", in *UIST'17*, 2017.