

**Ph.D. in Information Technology
Thesis Defense**

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Luca COMANDUCCI – XXXIV Cycle

Intelligent networked Music PERforMANce Experiences (IMPERMANENCE)

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Abstract:

We define as a Networked Music Performances (NMP) what occurs when musicians, displaced in different geographic locations, interact over a network to perform as if they were in the same room. While the recent developments of communication technologies and the consequent increase of the speed of digital networks produced the conditions for a dramatic decrease of virtual distances, creating a fertile environment for the development of NMPs, high speed networks do not suffice by themselves in creating an environment for NMP that feels engaging to the musicians. We may define the two broad classes of problems that need to be considered in NMPs as temporal and spatial factors. Temporal factors refer to all the elements that concur in enabling the synchronization of the musicians, while Spatial factors instead refer to all the issues related to the audiovisual perception of the musicians.

While several softwares and techniques have been proposed to separately solve the various issues that comes with creating a realistic NMP, no comprehensive solution has been yet proposed. In this thesis, we propose an across-the-board framework for NMPs that aims at solving at the same time both spatial and temporal factors, denoted Intelligent networked Music PERforMANce Experiences (IMPERMANENCE). We base our approach on the combination of signal processing and deep learning techniques that enable us to devise methods to solve both temporal and spatial factors using setups suitable to NMP contexts.

We first analyze what are the main requirements that need to be taken into account in order to create a satisfying NMP experience. For this purpose we first create a research framework, denoted neTworkEd Music PERfoRmANCe rEsearch (TEMPERANCE) in order to organize experiments with real musicians and analyze the obtained results. Informed by these findings, we accordingly develop the IMPERMANENCE framework.

PhD Committee

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