How to approach thousands of spectroscopic data acquired on historical stringed musical instruments? A methodological response.

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From 2013 to the present, a huge set of spectroscopic data has been collected on a large number of historical stringed musical instruments, the majority of which manufactured by Cremonese violin makers over the period from the 16th to the 19th century as a whole. All the instruments have been non-invasively investigated using the reflection FTIR [1] and XRF [2] spectroscopic techniques by means of contactless and portable instrumentation. The analyses have been conducted in the Arvedi Laboratory of Non-Invasive Diagnostics of the University of Pavia, hosted in the Museo del Violino (Cremona).

The present work aims at providing a workflow driven by chemometric approaches to manage spectroscopy-based musical instrument analysis.

To the purpose, a consistent database - consisting in a matrix (objects x variables) - has been constructed for each spectroscopic technique and explored by PCA (Principal Component Analysis). The PCA decomposition allowed the identification of sample groups to be risen to classes to develop classification models by PLS-DA (Partial Least Squares - Discriminant Analysis) algorithm. The classification approach, after a robust calibration, will allow us to discriminate objects (i.e. spectra) into classes based on materials, thus describing differences linked to violin makers and manufacturing methodologies [3].

The proposed workflow has been tested for the first time on the entire spectroscopic dataset currently available, in a perspective of continuous implementation and ampliation of it.

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