Abstract

For centuries, western cultures have written folk songs down. In the 21st century, this has resulted in large databases of music from all around the world. We have built, trained, and tested classifiers on Irish and Scandinavian dance music using songs encoded in symbolic representation (ABC format) downloaded from John Chamber’s online folk-song database. These tunes were sorted by dance type: Reel, Jig, Hambo, Pols, and Hornpipe. Raw data was preprocessed to be in the same key, have no ornaments, and no abbreviations. Features extracted were standardized to have zero mean and unit variance. Extra trees classification and variance thresholding allowed us to reduce feature dimensionality to 23. We classified our data using Support Vector Machines (SVM), Logistic Regression, Naïve Bayes, and K-means Clustering. We evaluated these classification algorithms using leave-one-out cross validation, trained on 80 percent of the data, and tested on 20 percent. Our SVM classification methods turned out to be the most accurate with less than 10% training and testing error.

Feature Selection

Figure 1. We identified 55 melodic and 10 rhythmic features describing the songs in our dataset. We extracted these features from our song corpus using tools for musical feature extraction from Music21. Above we show the training rate before (A) and after (B) feature selection.

Algorithm Test Accuracy

Table 1. Each line represents the accuracy on a 22-sample test set withheld from the 40-sample training set. All algorithms were validated using leave-one-out cross-validation (except K-means clustering, for which f1 score was the validation metric). The average training accuracy for each classification algorithm was: linear SVM, 0.91; RBF SVM, 0.93; K-means clustering, 0.85; Logistic Regression, 0.91; Naïve Bayes, 0.90.

Data Preparation

Western Music Notation

Vasgota polska

ABC Notation

V:\"astgli\"ota polska
O: Sweden
R: hambo-polska
Z: 2889 John Chambers <jc:trillian.mit.edu>
S: handwritten MS by JC from the 1970s
M: 3/4
L: 1/8
K: C
K: C
K: C
K: C
K: C

Figure 2. Output of various classification algorithms, plotted in the first two Principal Components of the training data. Gray circles represent the training data; and white circles represent the test data. Background colors show the decision boundary. Data is correctly classified when its color matches the background color. In SVM plots, golden circles surround the support vectors. Crosses mark the centroids of K-means. (A) Output of SVM with linear kernel for Hornpipe vs Jig. The data separates well. (B) Output of K-means, Naïve Bayes, Logistic Regression, and SVM with RBF Kernel for Hornpipe vs Jig. Note the RBF kernel overfits the data and K-means gives an incorrect decision boundary. (C) Output of Naïve Bayes for Hambo vs Pols, and SVM with 3rd Order Polynomial Kernel for Hornpipe vs Reel. In these cases, the data does not separate well.
