Lab 3: Music Mood Classification

1 Files included

TrainSet.csv – csv training set file with song descriptors
TrainSet.arff – arff training set file with song descriptors
TestSet.csv – csv test set file
TestSet.arff – arff test set file
Songs (mp3s) – https://drive.google.com/drive/folders/1Z7DHYcUiO5oaxlYujKGRGYxXlNN8bWnm?usp=sharing

2 Background

Automatic recognition of emotions in musical audio has gained increasing attention in the field of music information retrieval (MIR) during the past few years. The development in the field has coincided with the need for managing large collections of digital audio for the public via web services such as Spotify and Last.fm. This is reflected, for example, in the increasing number of submitted systems in the annual Audio Music Mood Classification (AMC) contest part of the Music Information Retrieval Evaluation eXchange3 (MIREX). The substantial variance in the submitted systems in the contest and in the approaches in the MIR field in general indicates a lack of consensus concerning the choice of an underlying psychological model for emotions or moods in music and the establishment of precise machine learning conventions.

Despite research in musicology studying the influence of specific cues in the musical structure on emotional expressions, there is no complete analytical consensus about the required "ingredients"—i.e., acoustical features extracted from music—to build the optimal models for emotion recognition, in the limits imposed by the subjectivity of emotions. The descriptors for each music track provided for this lab are the state-of-the-art descriptors used in this area (see table in next page for details).

3 Tasks

Your main task is to obtain the classifier with the highest accuracy possible and to determine which kind of music features are most informative for determining the mood of a song. **A second task** is to investigate what kind of features (timbre, rhythm, pitch, dynamics, structure or harmony) are more relevant for predicting emotion in music. In particular, your task is to explore different feature sets (obtained by applying filter and wrapper selection methods) and machine learning algorithms to obtain the most accurate classifier (evaluated on the test data).

A third task is to perform error analysis: You should look at the specific errors that your system makes (by examining the misclassified songs and also looking at the confusion matrix), then try to understand why it makes them (is the data unambiguous? Is the problem ill-posed? What would be the accuracy of a human performing the task? Can you improve the model? (by for instance cleaning up outliers).

Lastly, you may use the wav files provided in the drive to extract spectrograms and apply deep learning techniques to investigate if you can improve the accuracy of your previous model.

Submitting your answer

The Lab is individual. Submission is through the Aula Global. Submission is through the Aula Global. Submissions should contain the link to your google colab notebook. The notebook should include your name(s), your code and a text cell at the end with a summary of your results and a very brief discussion of them. Deadline is specified in the Aula Global.

TABLE II
EXTRACTED FEATURE SET. m = MEAN, d = STANDARD DEVIATION, l = SLOPE, h = ENTROPY

Category	No.	Feature	Acronyms
Dynamics	1-3	RMS energy	Em, Ed, El
	4	Low-energy ratio	LEm
	5	Attack time	ATm
	6-7	Attack slope	ASm, ASd
Rhythm	8	Event density	EDm
	9-10	Fluctuation peak (pos., mag.)	FPm, FMm
	11	Fluctuation centroid	FCm
	12-13	Tempo	Tm, Td
	14-15	Pulse clarity	PCm, PCd
Pitch	16-17	Pitch	Pm, Pd
	18-21	Chromagram (unwrapped) centr.	Cm, Cd, Cl, Ch
Harmony	22-23	Key clarity	KCm, KCd
	24-25	Key mode (majorness)	Mm, Md
	26	HCDF	Hm
	27	Entropy (oct. collapsed spectr.)	ESm
	28	Roughness	Rm
	29-30	Inharmonicity	Im, Id
Timbre	31-32	Brightness (cut-off 110 Hz)	Bm, Bd
	33-34	Spectral centroid	SCm, SCd
	35-36	Zerocross	Zm, Zd
	37	Spread	Sm
	38	Skewness	Km
	39-40	Spectral entropy	SEm, SEd
	41	Spectral flux	SFm
	42	Flatness	Fm
	43-44	Regularity	REm, REd
	45-46	1st MFCC + delta	M1m, D1m
	⋮	⋮	⋮ ⋮
	57-58	7th MFCC + delta	M7m, D7m
Structure	59-60	Repetition (spectrum)	RSm, RSd
	61-62	Repetition (rhythm)	RRm, RRd
	63-64	Repetition (tonality)	RTm, RTd
	65-66	Repetition (register)	RGm, RGd