Machine Learning and Pattern Classification

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Text Features:
Team Observe

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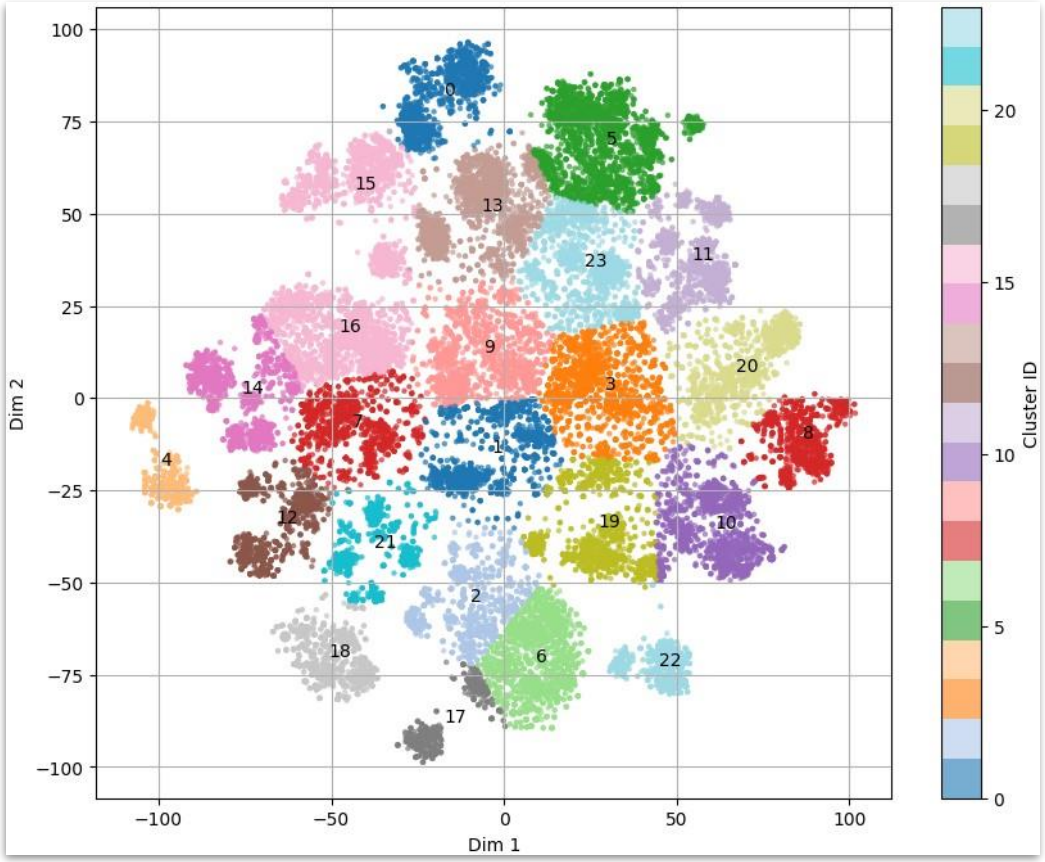
Cluster the text features.
Can you find meaningful clusters?



Clear cluster separation in the text feature space after applying t-SNE for dimensionality reduction, followed by k-Means clustering

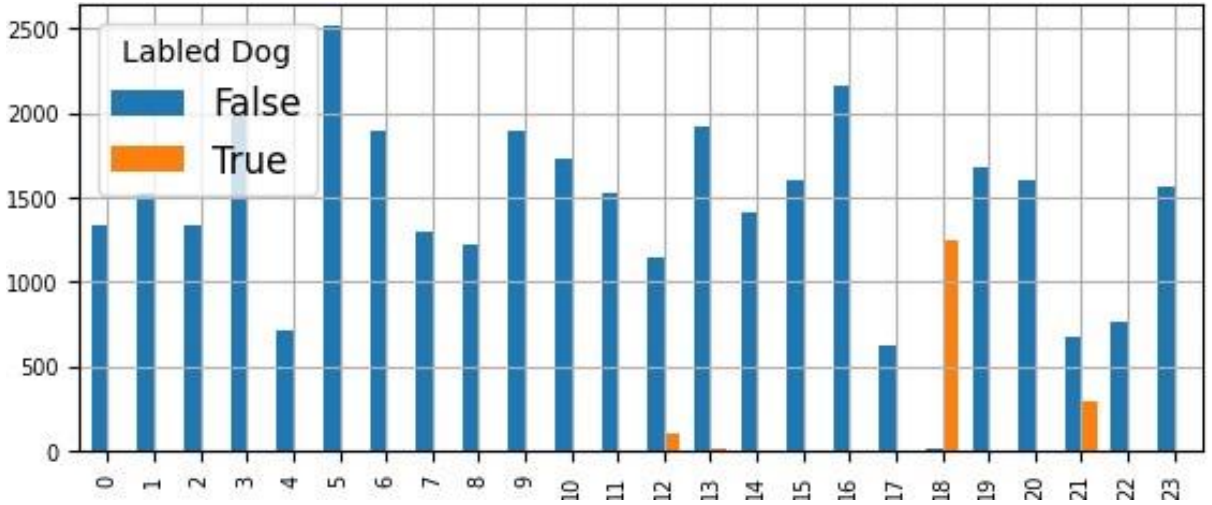
Cluster	Topic	Most common Words
0	Flowing Water	water, waves, splashing
1	Applause and Crowds	clapping, people, door
2	Distant Bird Calls	bird, chirping, distance
3	Metal Hammering	metallic, hammer, metal
4	Cat Sounds	cat, meowing, purring
5	Vehicles Passing By	engine, car, passing
6	Singing Birds	bird, chirping, birds
7	Humans Shouting and Singing	man, singing, loudly
8	Church Bells and Chimes	bell, ringing, metallic
9	Footsteps and Muffled Sounds	person, footsteps, walking
10	Instrumental Music	guitar, playing, piano
11	Power Tools and Construction	drill, chainsaw, loud
12	Snoring and Breathing	snoring, person, man
13	Storms: Wind and Thunder	wind, noise, thunder
14	Babies and Child Voices	baby, laughing, crying
15	Rain and Fire Crackling	water, rain, falling
16	People Talking	talking, people, man
17	Farm Animals: Sheep and Goats	sheep, bleating, birds
18	Dog Barking	dog, barking, barks
19	Horns and Drums	horn, drum, honking
20	Alarms and Sirens	alarm, siren, beeping
21	Mixed Animal Sounds	dog, cow, mooing
22	Insect Buzzing and Flying	buzzing, insect, flying
23	Train and Machine Humming	train, machine, noise

Most common words per cluster, showing a clear semantic separation between the text-based clusters

Design a labeling function for classes dog and cat. Do the annotations labeled as dog or cat sounds form tight clusters in the text and audio feature space?

Labeling function dog:

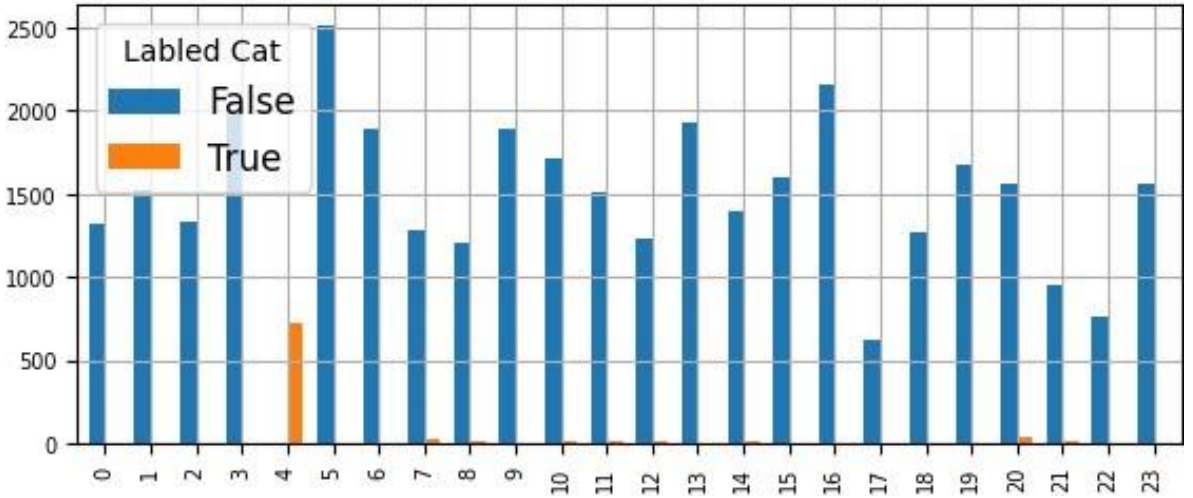
Keywords used for labeling function:
"dog", "bark", "puppy", “growling”



Distribution of samples labeled “Dog” across all text clusters in orange

Labeling function cat:

Keywords used for labeling function:
"cat", "citten", "meow", "purr"

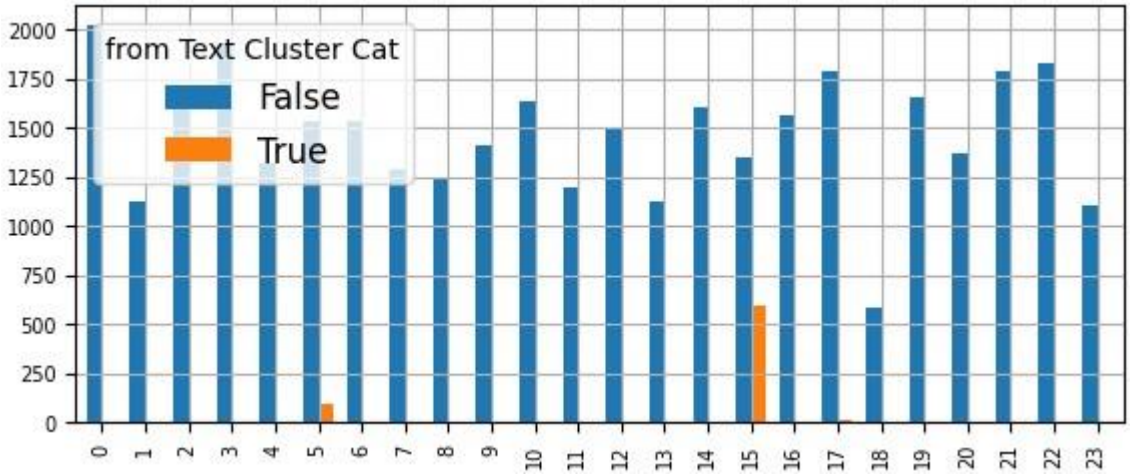


Distribution of samples labeled “Cat” across all text clusters in orange

How well do the audio feature clusters align with text clusters?

Text cluster “Cats” vs audio feature clusters:

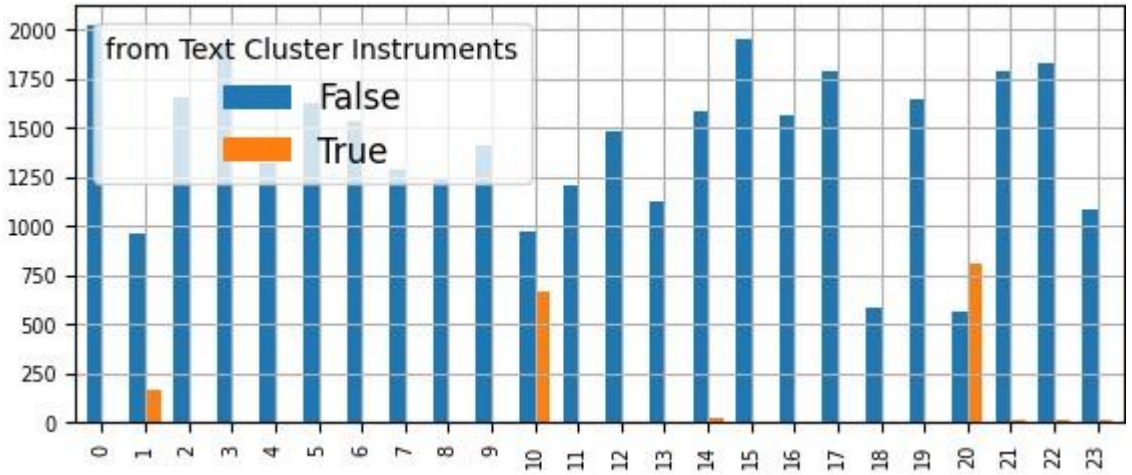
The text cluster for “Cats” was laid over all audio feature clusters to identify any patterns in its distribution



Text cluster for “Cats“ laid over all audio feature clusters, showing a tight clustering in cluster 15

Text cluster “Instruments” vs audio feature clusters:

The text cluster for “Instruments” was laid over all audio feature clusters to identify any patterns in its distribution



Text cluster for “Instruments” laid over all audio feature clusters, showing a spread primarily across clusters 1, 10 and 20

Text Feature Conclusion

a. The text feature space was highly clusterable, resulting in multiple meaningful clusters.

b. The labeling functions for “Cat” and “Dog” formed tight, well defined clusters, in the audio space and especially in the text space.

c. The majority of text clusters aligned with one or more audio clusters, indicating a strong relationship between semantic meaning and sound similarity.