How music impacts mental health from a set of listening attributes.

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Why I wanted to study it / Intended Goals

- I believed that the study that was used for the dataset was interesting, as one who listens to lots of music and likes psychology.
- Does Music have any effect on mental health and can it be predicted? **What factors contribute**?
- Data analysis has been done, however no Machine Learning Algorithms used

Dataset used

- Music and Mental Health Survey Results
- Found on kaggle.com!!
- Music & Mental Health Survey Results

kaggle™

Cleaning the Data

- Used excel to help clean the data
  - Removed rows where ‘music effects’ are not present
  - Removed Columns that were not useful (Timestamp, Primary Streaming, Permissions)
  - Autofilled a few null values such as some bpms, and age
- Turned the excel file into an arff file

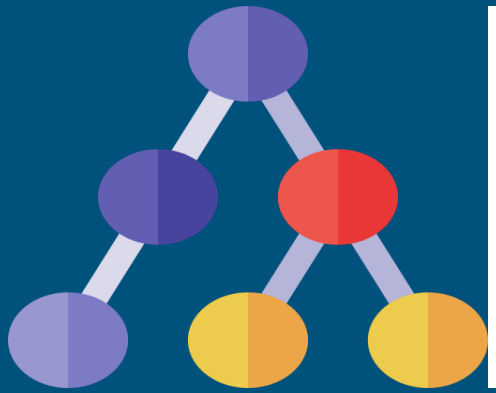
Machine Learning Algorithms

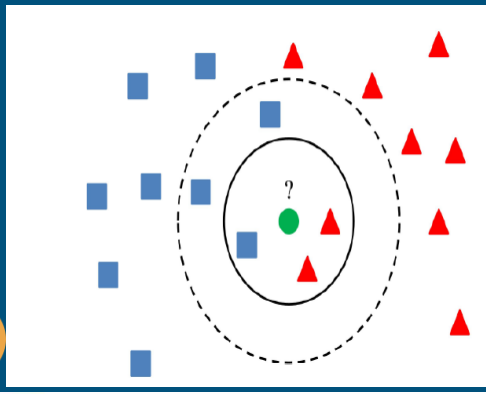
Used in previous assignments

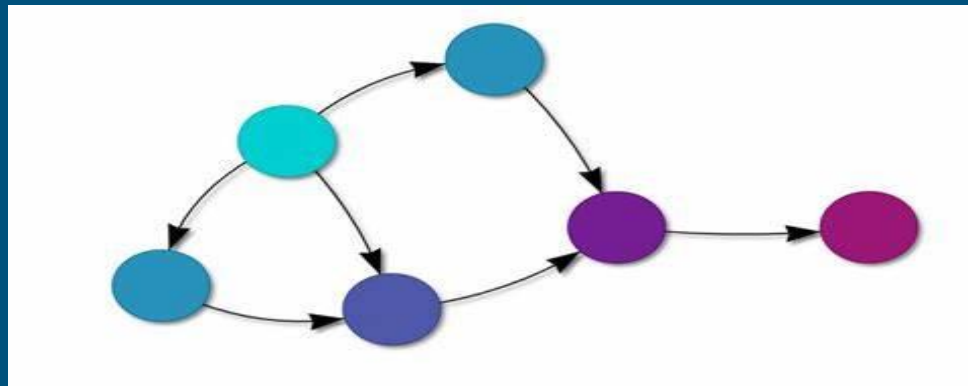
- **Bayes Net Algorithm**
- **J48 Decision Tree**
- **One R Rule**

Not used in previous assignments

- **SMO Function**
- **Simple KNN Means**





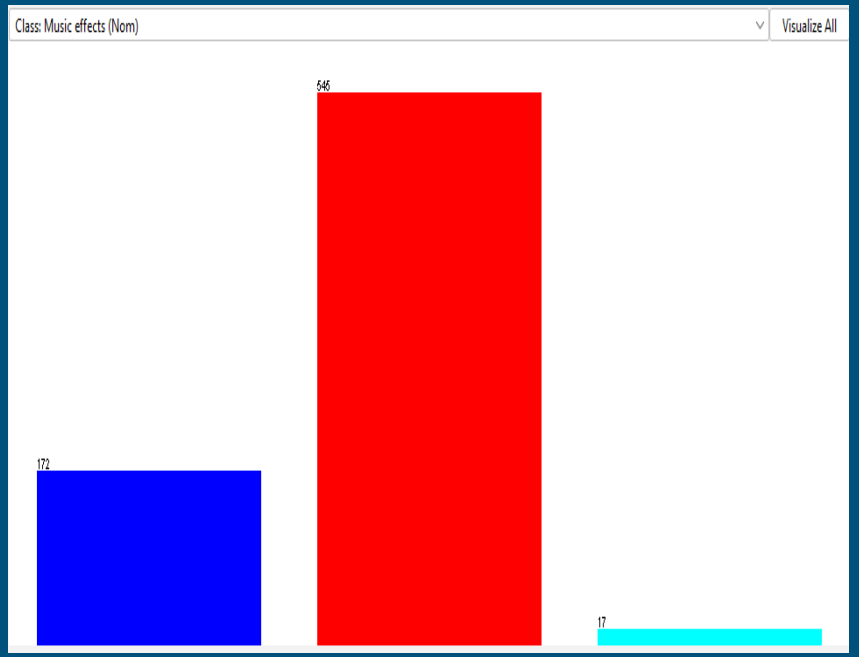


Attributes Used (Target)

Target Attribute: Music Effects

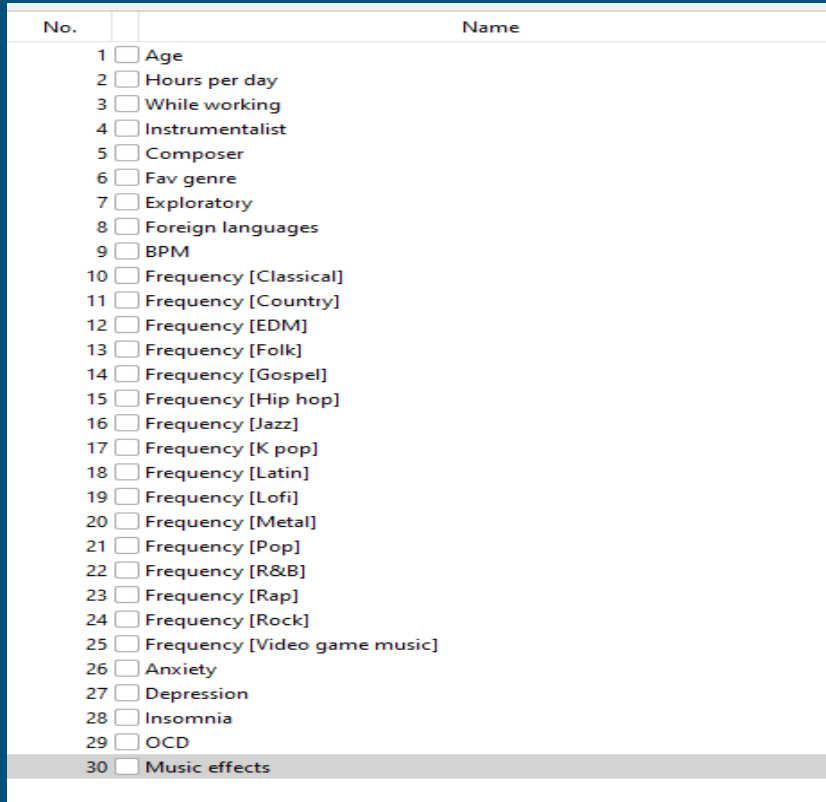
(Does music improve mental health)

- **Improve (545 instances)**
- **No Effect (172 instances)**
- **Worsen (17 instances)**



Attributes Used (Non-Target)

- Age
- Hours Per Day
- While Working
- Composer and Instrumentalist
- Favorite Genre
- BPM (Beats Per minute / Speed)
- Frequency (Genres)
- Mental Health
  - OCD
  - Depression
  - Insomnia
  - Anxiety



No.	Name
1	Age
2	Hours per day
3	While working
4	Instrumentalist
5	Composer
6	Fav genre
7	Exploratory
8	Foreign languages
9	BPM
10	Frequency [Classical]
11	Frequency [Country]
12	Frequency [EDM]
13	Frequency [Folk]
14	Frequency [Gospel]
15	Frequency [Hip hop]
16	Frequency [Jazz]
17	Frequency [K pop]
18	Frequency [Latin]
19	Frequency [Lofi]
20	Frequency [Metal]
21	Frequency [Pop]
22	Frequency [R&B]
23	Frequency [Rap]
24	Frequency [Rock]
25	Frequency [Video game music]
26	Anxiety
27	Depression
28	Insomnia
29	OCD
30	Music effects

Findings weren’t great..

One-R Algorithm

```
Age:
        < 25.5  -> Improve
        < 26.5  -> No Effect
        < 33.5  -> Improve
        < 35.5  -> No Effect
        < 50.5  -> Improve
        < 56.5  -> No Effect
        < 84.5  -> Improve
        >= 84.5 -> No Effect
(556/734 instances correct)


Time taken to build model: 0.01 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         551               75.0681 %
Incorrectly Classified Instances       183               24.9319 %
Kappa statistic                          0.1194
Mean absolute error                      0.1662
Root mean squared error                  0.4077
Relative absolute error                 63.2016 %
Root relative squared error            112.6033 %
Total Number of Instances              734
```

- Determines the most important attribute: **Age**
- 75% correct instances, 24% incorrect
- Kappa Value: 0.11 (Slight)
- This is considered a slight (bad) Model in Landis and Koch Terms

J48 Algorithm

```
Age <= 14
|   Depression <= 9: Improve (27.0/2.0)
|   Depression > 9: Worsen (2.0)
Age > 14
|   While working = Yes
|   |   Depression <= 0
|   |   |   Frequency [Folk] = Never
|   |   |   |   Frequency [Latin] = Very frequently: No Effect (3.0/1.0)
|   |   |   |   Frequency [Latin] = Sometimes
|   |   |   |   |   Insomnia <= 5: Improve (4.0)
|   |   |   |   |   Insomnia > 5: No Effect (2.0)
|   |   |   |   Frequency [Latin] = Never
|   |   |   |   |   OCD <= 2: No Effect (14.78/4.0)
|   |   |   |   |   OCD > 2: Improve (3.0)
|   |   |   |   Frequency [Latin] = Rarely: Improve (4.0)
|   |   |   Frequency [Folk] = Rarely
|   |   |   |   Age <= 20: No Effect (2.0)
|   |   |   |   Age > 20: Improve (12.0/1.0)
|   |   |   Frequency [Folk] = Sometimes: Improve (7.0/1.0)
|   |   |   Frequency [Folk] = Very frequently: No Effect (4.0)
|   |   Depression > 0: Improve (496.78/101.0)
|   While working = No
|   |   Fav genre = Latin: Improve (0.0)
|   |   Fav genre = Rock
|   |   |   Instrumentalist = Yes: Improve (10.0/2.0)
|   |   |   Instrumentalist = No
|   |   |   |   Frequency [Latin] = Very frequently: No Effect (0.0)
|   |   |   |   Frequency [Latin] = Sometimes: Improve (2.0/1.0)
|   |   |   |   Frequency [Latin] = Never
|   |   |   |   |   Frequency [K pop] = Very frequently: No Effect (1.0)
|   |   |   |   |   Frequency [K pop] = Rarely: Improve (4.0)
|   |   |   |   |   Frequency [K pop] = Sometimes: No Effect (1.0)
|   |   |   |   |   Frequency [K pop] = Never
|   |   |   |   |   |   Frequency [Pop] = Very frequently: Improve (4.0)
|   |   |   |   |   |   Frequency [Pop] = Sometimes
|   |   |   |   |   |   |   Foreign languages = Yes: Improve (2.0)
|   |   |   |   |   |   |   Foreign languages = No
|   |   |   |   |   |   |   |   Frequency [Lofi] = Rarely: Improve (3.0/1.0)
|   |   |   |   |   |   |   |   Frequency [Lofi] = Sometimes: Improve (1.0)
|   |   |   |   |   |   |   |   Frequency [Lofi] = Very frequently: No Effect (0.0)
|   |   |   |   |   |   |   |   Frequency [Lofi] = Never: No Effect (6.0)
|   |   |   |   |   |   Frequency [Pop] = Rarely: No Effect (4.22)
|   |   |   |   |   |   Frequency [Pop] = Never: No Effect (0.0)
|   |   |   |   Frequency [Latin] = Rarely
|   |   |   |   |   Age <= 33: No Effect (4.0)
|   |   |   |   |   Age > 33: Improve (2.0)
|   |   Fav genre = Video game music: No Effect (8.0/2.0)
|   |   Fav genre = Jazz: No Effect (3.0)
```

```
Number of Leaves  :     71

Size of the tree :      99


Time taken to build model: 0.01 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         532               72.4796 %
Incorrectly Classified Instances       202               27.5204 %
Kappa statistic                          0.0848
Mean absolute error                      0.2451
Root mean squared error                  0.381
Relative absolute error                 93.1916 %
Root relative squared error            105.2221 %
Total Number of Instances              734

=== Detailed Accuracy By Class ===

                 TP Rate   FP Rate   Precision   Recall  F-Measure   MCC
                 0.134     0.068     0.377       0.134   0.197       0.101
                 0.934     0.862     0.757       0.934   0.836       0.112
                 0.000     0.001     0.000       0.000   0.000       -0.006
Weighted Avg.    0.725     0.656     0.651       0.725   0.667       0.107

=== Confusion Matrix ===

   a   b   c   <-- classified as
  23 149   0 |   a = No Effect
  35 509   1 |   b = Improve
   3  14   0 |   c = Worsen
```

SMO (Support Vector Machine)

```
+       0.0255 * (normalized) Frequency [R&B]=Never
+       0.0093 * (normalized) Frequency [R&B]=Very frequently
+       0.458  * (normalized) Frequency [R&B]=Rarely
+       0.1407 * (normalized) Frequency [Rap]=Very frequently
+      -0.0841 * (normalized) Frequency [Rap]=Rarely
+      -0.208  * (normalized) Frequency [Rap]=Never
+       0.1514 * (normalized) Frequency [Rap]=Sometimes
+       0.3236 * (normalized) Frequency [Rock]=Never
+      -0.2757 * (normalized) Frequency [Rock]=Very frequently
+      -0.1992 * (normalized) Frequency [Rock]=Rarely
+       0.1512 * (normalized) Frequency [Rock]=Sometimes
+      -0.3041 * (normalized) Frequency [Video game music]=Sometimes
+      -0.1907 * (normalized) Frequency [Video game music]=Rarely
+       0.3141 * (normalized) Frequency [Video game music]=Very frequently
+       0.1807 * (normalized) Frequency [Video game music]=Never
+      -0.1258 * (normalized) Anxiety
+       1.4042 * (normalized) Depression
+      -0.0413 * (normalized) Insomnia
+       0.1847 * (normalized) OCD
-       2.4794

Number of kernel evaluations: 51535 (90.909% cached)



Time taken to build model: 0.63 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         534               72.752  %
Incorrectly Classified Instances       200               27.248  %
Kappa statistic                          0.0061
Mean absolute error                      0.2925
Root mean squared error                  0.3792
Relative absolute error                111.2072 %
Root relative squared error            104.7398 %
Total Number of Instances              734
```

- Classifies the target attribute (Music Effects) using a hyperplane to separate instances to classes based on distance
- 72% correct instances, 27% incorrect
- Kappa Value: 0.0061 (Slight)
- This is considered a slight (bad) Model in Landis and Koch Terms

Bayes Net Algorithm

```
Age(2): Music effects
Hours per day(1): Music effects
While working(2): Music effects
Instrumentalist(2): Music effects
Composer(2): Music effects
Fav genre(16): Music effects
Exploratory(2): Music effects
Foreign languages(2): Music effects
BPM(1): Music effects
Frequency [Classical](4): Music effects
Frequency [Country](4): Music effects
Frequency [EDM](4): Music effects
Frequency [Folk](4): Music effects
Frequency [Gospel](4): Music effects
Frequency [Hip hop](4): Music effects
Frequency [Jazz](4): Music effects
Frequency [K pop](4): Music effects
Frequency [Latin](4): Music effects
Frequency [Lofi](4): Music effects
Frequency [Metal](4): Music effects
Frequency [Pop](4): Music effects
Frequency [R&B](4): Music effects
Frequency [Rap](4): Music effects
Frequency [Rock](4): Music effects
Frequency [Video game music](4): Music effects
Anxiety(1): Music effects
Depression(1): Music effects
Insomnia(1): Music effects
OCD(1): Music effects
Music effects(3):
LogScore Bayes: -19418.772482334323
LogScore BDeu: -19935.480485904693
LogScore MDL: -19916.75241005569
LogScore ENTROPY: -19227.20821656547
LogScore AIC: -19436.20821656547


Time taken to build model: 0.01 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         505               68.8011 %
Incorrectly Classified Instances       229               31.1989 %
Kappa statistic                          0.1267
Mean absolute error                      0.2506
Root mean squared error                  0.3854
Relative absolute error                 95.2932 %
```

- Algorithm that classifies how nontarget attributes relate to the target attribute by finding probabilities with bayes theorem.
- 68% correct instances, 31% incorrect instances
- Kappa: 0.12% (Slight)
- This is considered a slight (bad) Model in Landis and Koch Terms

Simple K Means Algorithm

```
Time taken to build model (full training data) : 0.05 seconds

=== Model and evaluation on training set ===

Clustered Instances

0      221 ( 30%)
1      242 ( 33%)
2      271 ( 37%)


Class attribute: Music effects
Classes to Clusters:

   0   1   2  <-- assigned to cluster
  49  45  78 | No Effect
 168 192 185 | Improve
   4   5   8 | Worsen

Cluster 0 <-- Worsen
Cluster 1 <-- Improve
Cluster 2 <-- No Effect

Incorrectly clustered instances :       460.0    62.6703 %
```

- Categorized all instances to 3 classes:
  - Cluster 0: Improve Mental Health
  - Cluster 1: No Effect on Mental Health
  - Cluster 2: Worsen Mental Health
- Clustered Instances
  - Improve Mental Health: 221 instances
  - No effect on Mental Health: 242 instances
  - Worsen Mental Health: 271 instances
- Incorrect clustered instances: 62%!!! (Worse model yet)

What Went Wrong?

Possible Problems of the Dataset

- Dataset was unbalanced, 74% of users say it would improve, 25% has no effect/worsens mental health
- Vague in determining how it impacts a person's mental health
- Dataset was made as a survey, with the statistician having no control of external factors (get a domain expert)

What can be taken away?

- Most people that listen to music most likely will improve their mental health!
- There are no specific attributes on what determines if music impacts mental health or not.
- A dataset which was formed with a survey is not the greatest for classification analysis (Kappa values were low)
- Survey should be specific on what mental health improvements entails
  - If it helps cope with their emotions
  - If the user listens to music while working does it help?

Any Questions?????