Oregon State University
COMPUTER SCIENCE

PRODUCTIVITY PLAYLIST

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Introduction

We listen to music for enjoyment, distraction, joy, comfort, and focus. People curate music playlists to reflect and affect their own moods. Popular music platforms like Spotify also create playlists of songs with similar moods by feeding data on a song's characteristics to machine learning models which create personalized playlists for users. The music from these playlists is not optimized to steer users to productivity, and often distracts instead. Previous affective music studies create playlists of songs with a similar emotional state, but those playlists were not dynamic based on mood [1]. We create a "productivity playlist," an intelligent algorithm that creates playlists that automatically adjust based on the user's current mood to lead them towards a happier or more productive state.

Dataset

We use the Arousal-Valence circumplex model of emotions since its continuous nature allows for a path to traverse its two-dimensional space [3]. We found two datasets containing many songs and their associated points in this model: the DEAM 2016 and the Deezer 2018 datasets [2, 4]. After statistically comparing the Deezer and DEAM datasets, we chose the Deezer 2018 dataset since it contains more songs (18,000+) with a wider spread of emotional points. This will allow us to create large playlists that can travel through a greater range of emotions.

Methods

Our algorithm, given a starting song, a target song, and a desired length, creates a smooth, linear path with consistent steps through the Arousal-Valence space. We use a K-Nearest Neighbors (KNN) machine learning model to interpolate this path. The algorithm moves from a current song towards the destination in consistent steps, finding the nearest neighbors to a "target" point. We find the smoothest next song out of these points using a distance metric and repeat until we reach the destination.

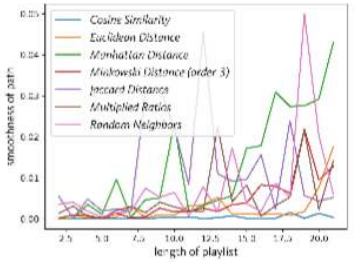


Figure 1:
A comparison of various distance metrics in creating smooth playlists of various lengths with our algorithm. Each playlist was compared with MSE to a "perfect" line from the origin to the destination.

Results

To ensure our playlists are as smooth as possible, we chose several popular distance metrics to compare and used mean-squared error to evaluate our playlists (see Figure 1). After discovering that Cosine Similarity produced the smoothest playlists, we used our algorithm to create smooth dynamic playlists in the Arousal-Valence space to bridge the emotions between given starting and target songs (see Figure 2).

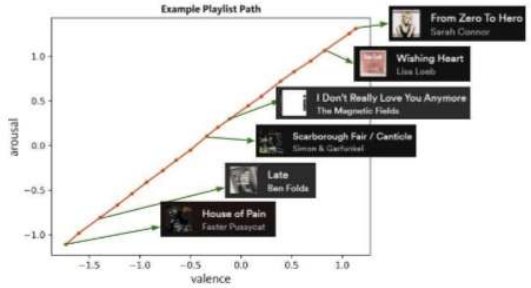


Figure 2: A 21-song playlist created by the algorithm. It moves smoothly from depression to excitement.

Discussion

This work is a starting point for further research. Currently, we are examining ways to detect a user's emotional state using facial recognition, to automatically tune playlists from a user's emotion. We are also examining Spotify's built-in audio feature data to create dynamic playlists with similar genres. Playlists made by our algorithm could be powerful tools in mental health and productivity, gently guiding users to happier or more focused states of mind.

References

[1] Chung-Yi Chi, Richard Tzong-Han Tsai, and Jane Yung-jen Hsu. 2010. A reinforcement learning approach to emotion-based automatic playlist generation. In 2010 International Conference on Technologies and Applications of Artificial Intelligence, IEEE, 60–65.
[2] Remi Delbouys, Romain Hennequin, Francesco Piccoli, Jimena Royo-Letelier, and Manuel Moussallam. 2018. MUSIC MOOD DETECTION BASED ON AUDIO AND LYRICS WITH DEEP NEURAL NET. (2018), 6.
[3] Jonathan Posner, James A Russell, and Bradley S Peterson. 2005. The circumplex model of affect: an integrative approach to affective neuroscience, cognitive development, and psychopathology. Dev. Psychopathol. 17, 3 (2005), 715–734. DOI:https://doi.org/10.1017/S0954579405050340
[4] Mohammad Soleymani, Anna Aljanaki, and Yi-Hsuan Yang. DEAM: MediaEval Database for Emotional Analysis in Music. 3.

Emotion-based playlists are everywhere.



Mood Booster
Get happy with this pick-me-up playlist full of current feel-good songs!
5,706,063 FOLLOWERS



Feelin' Myself
When you feel like you're 100% that b**** Cover: Flo Milli
803,491 FOLLOWERS



Have a Great Day!
Feel great with these timelessly fun songs!
4,748,137 FOLLOWERS



Tender
Raw, sentimental feels.
318,042 FOLLOWERS



Drifting Apart
Feelings fade, people change.
157,715 FOLLOWERS



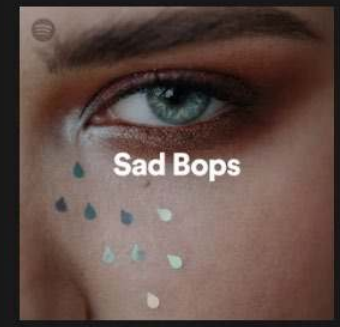
Down In The Dumps
The latest pop songs that are totally cry worthy.
524,476 FOLLOWERS



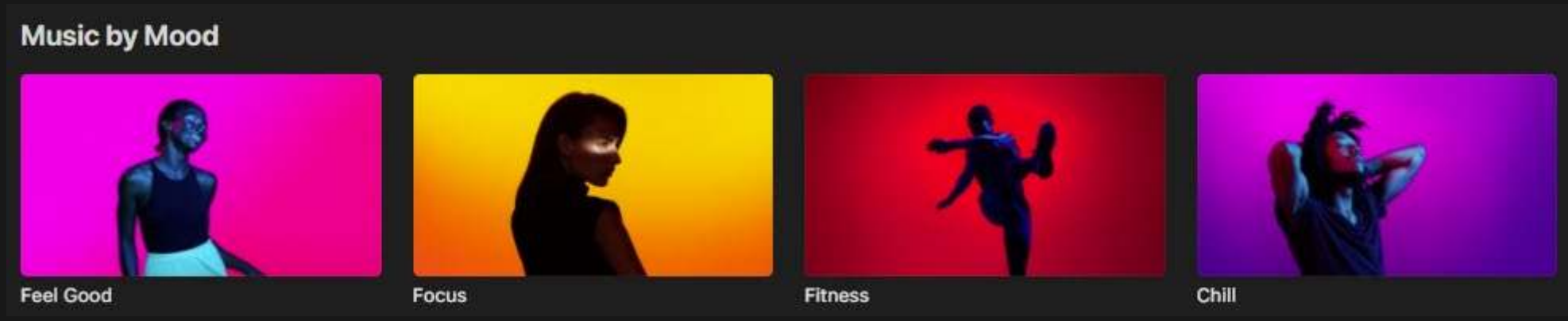
Confidence Boost
You're on top of the world. Don't forget it.
3,315,415 FOLLOWERS



Tear Drop
Emo rap feelings for the misunderstood. Cover: Juice WRLD
700,706 FOLLOWERS



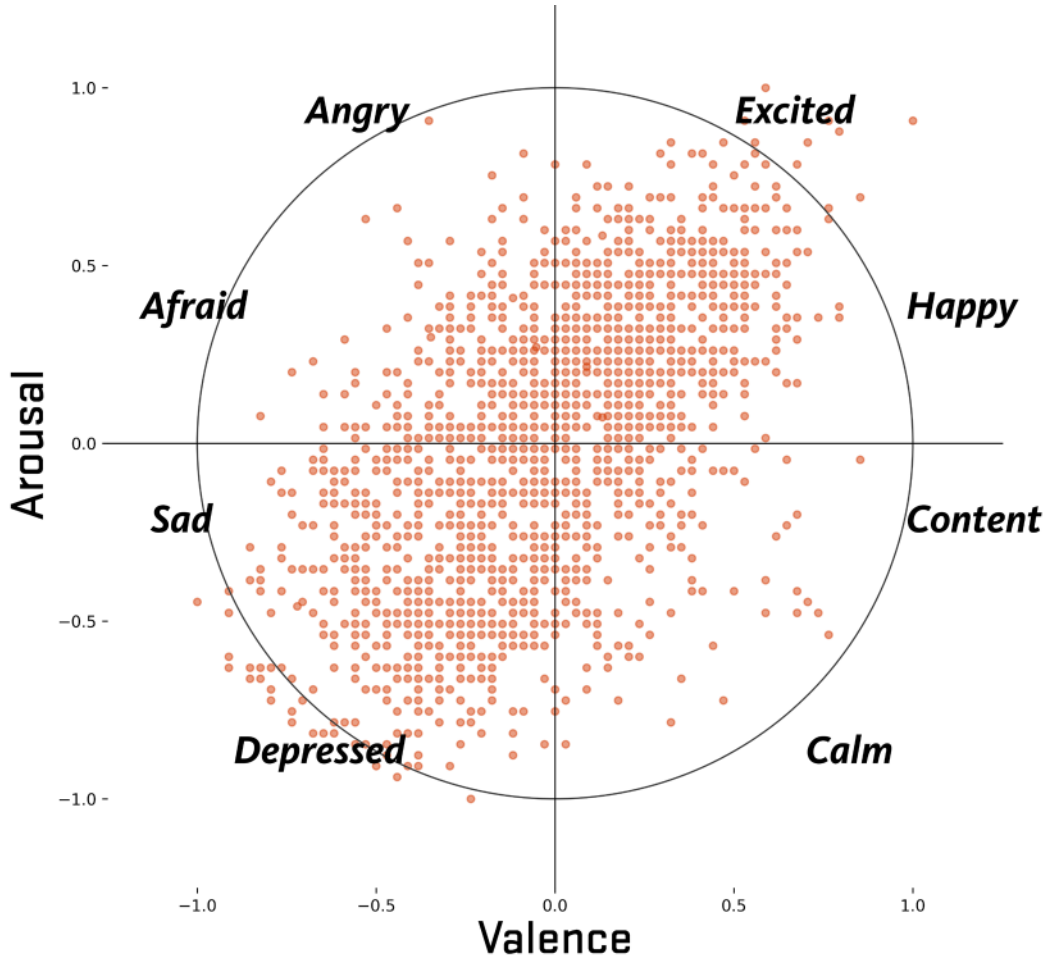
Sad Bops
For all of us dancing on our own.
268,819 FOLLOWERS





Van Life
Home is where you park it.
219,665 FOLLOWERS

Arousal-Valence Emotion Space



DEAM 2018

- 1,800+ songs
- 2,700+ unique points
- Based on last.fm tags

Making an emotional path.

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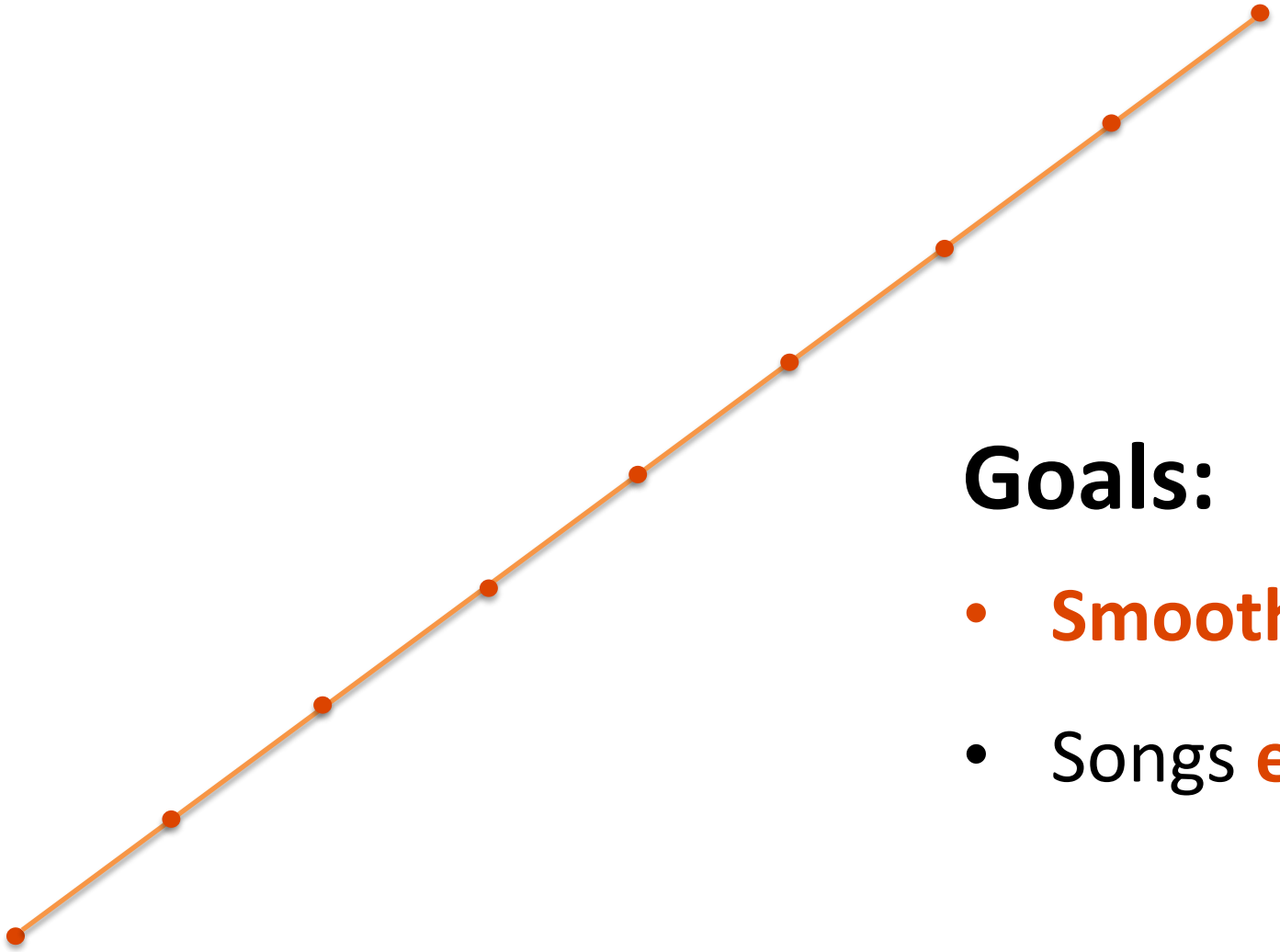
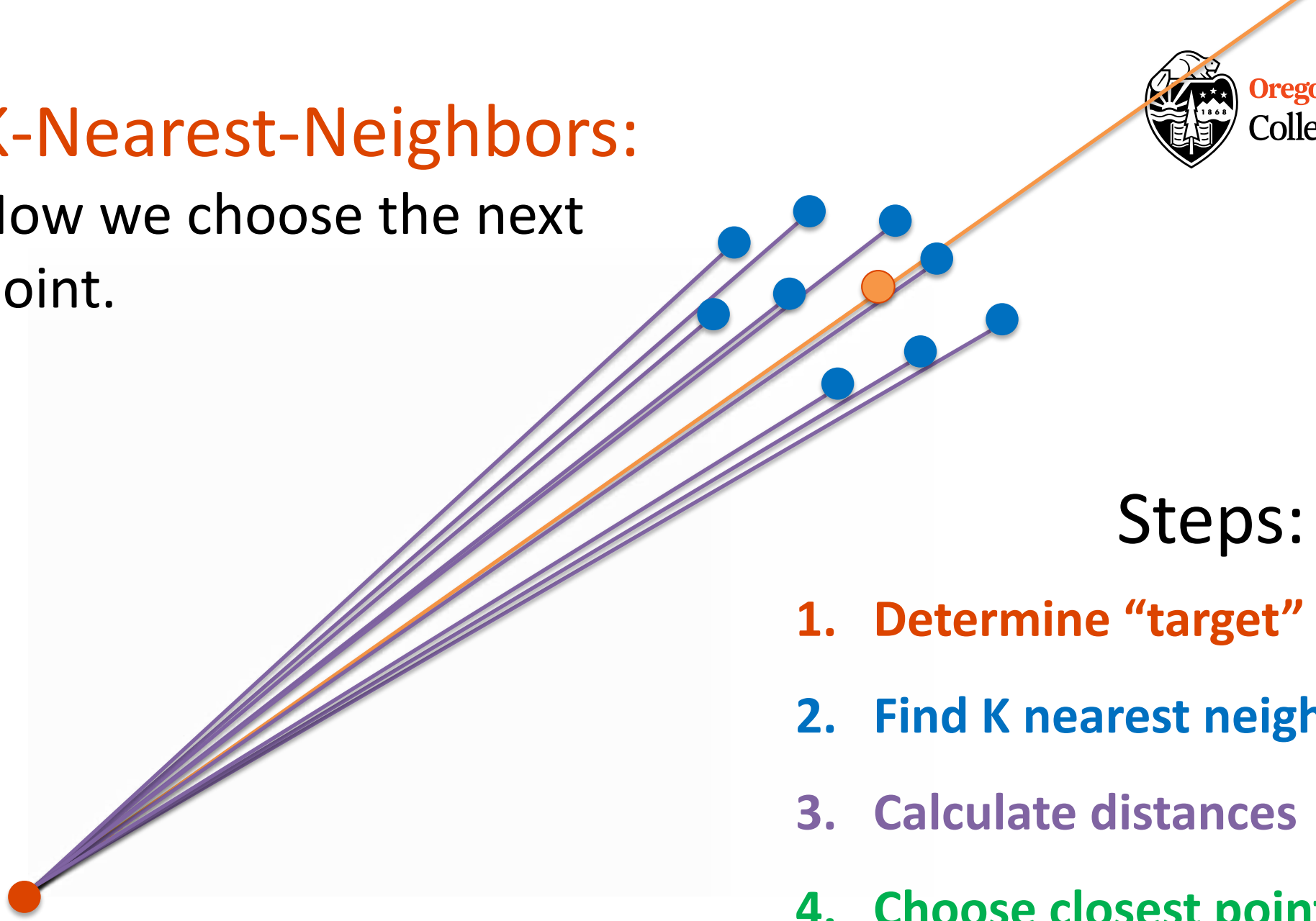


Goals:

- **Smooth** journey
- Songs **evenly spaced**

K-Nearest-Neighbors:

How we choose the next point.



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Steps:

1. **Determine “target” point**
2. **Find K nearest neighbors**
3. **Calculate distances**
4. **Choose closest point to target**

Testing our emotional path.

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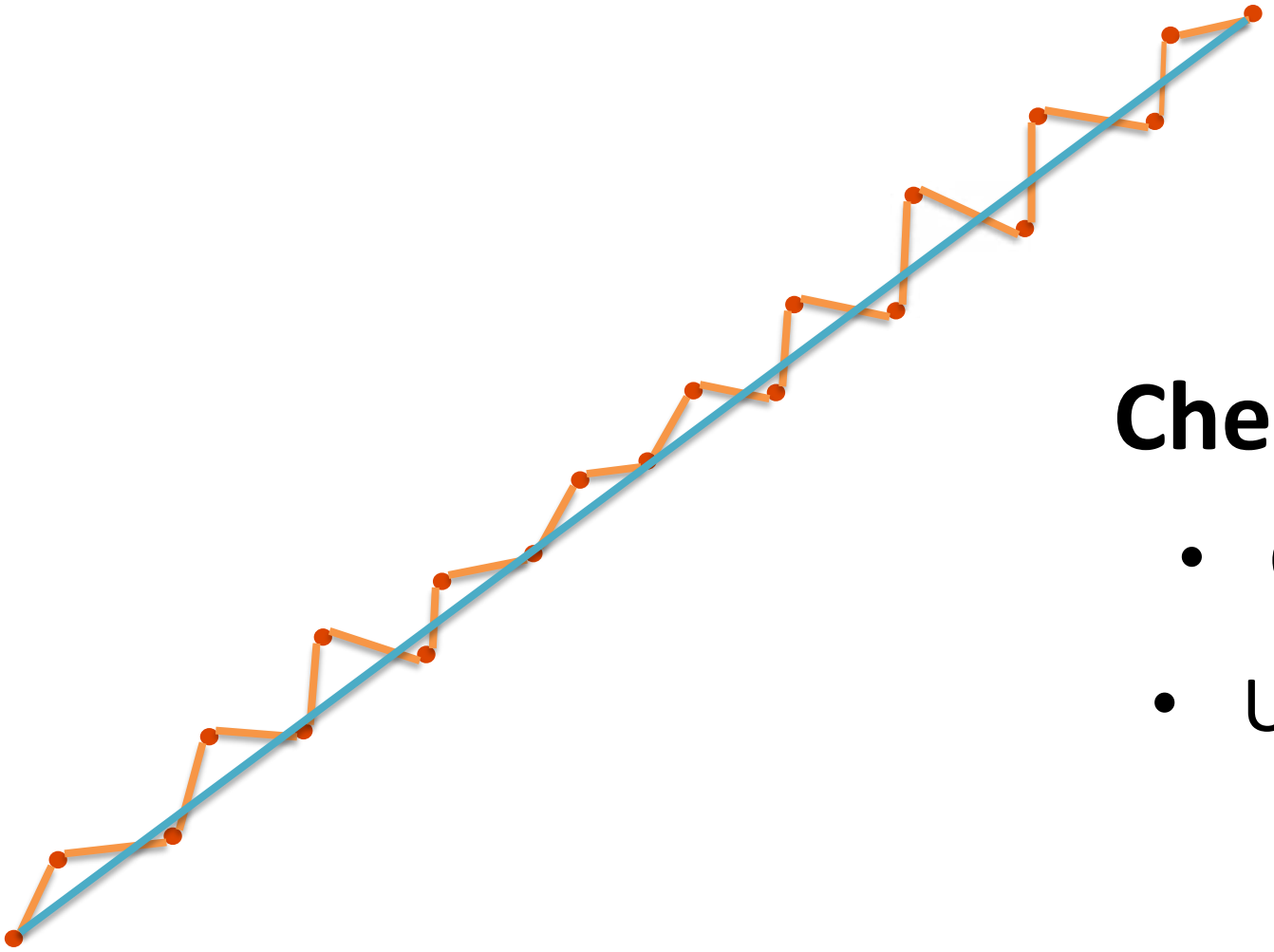
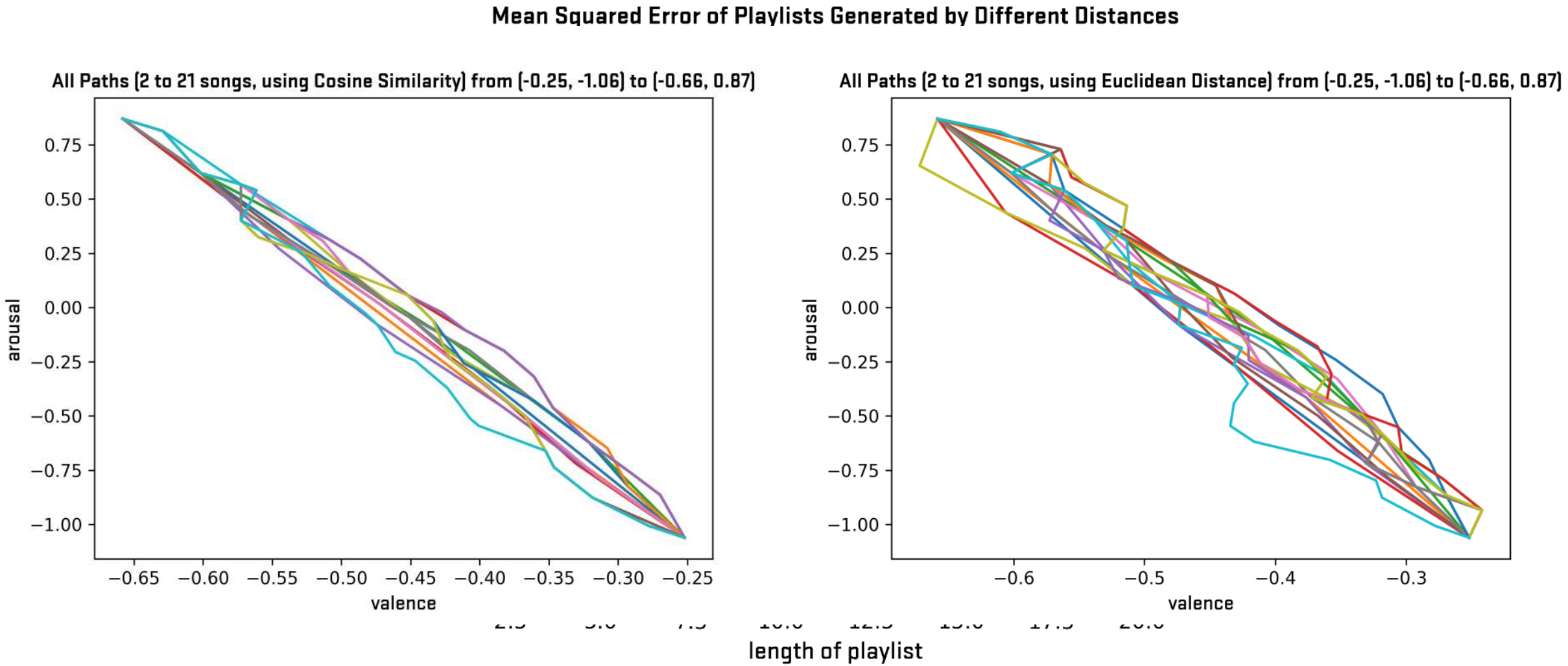


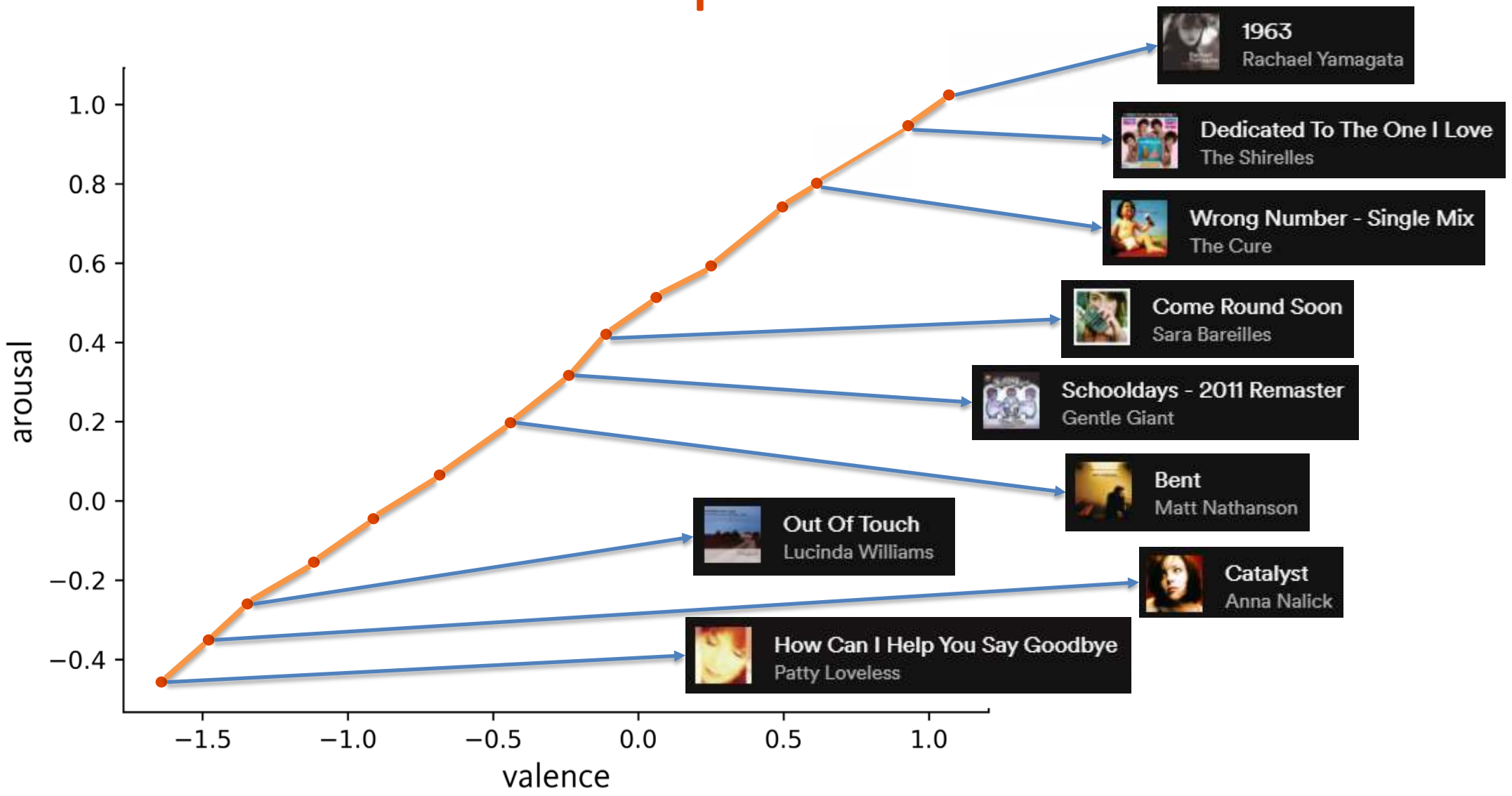
Checking Smoothness:

- Compare to **perfect line**
- Use **mean-squared error**

Results of the distance metric test.



Let’s look at an example.



Conclusion + Next Steps

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Successfully makes smooth playlists between emotions

Starting point for further integration with facial emotion recognition, song genre selection, etc.

Potential uses in mental health, productivity, etc.