

# Song Recommendation System on Mobility Based on Geotagged Tweets and User Preferences

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## self-introduction

Name: Nobutaka Hayashi

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## Research background

- Surrounding conditions and atmosphere are important factors for recommending music



- Recommend songs that match the atmosphere of the spots present in the travel route and the user's preferences

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# Overview of the music recommendation system on the move

Table 1 User Playback History (User Profile)

Artist	Song Title	Lyric
Masumi	"Apple Song"	~apple red~
Mori Calliope	"Off With Their Heads"	~I'm savege~
Mori Calliope	"Dance Past Midnight"	~Don't call me lazy~

Table 2 Tweet content

Spot	Tweet
Clotho Park	The sunset is red and beautiful
Clotho Park	The flowers in bloom in Park are beautiful

Sagrada Familia



Destination  
(Sagrada Familia)

In Cloth Park Artist Extraction

Artist	Characteristic words
ReoNa	Flower • Red • life
LiSA	Guren • Sky • Flower

Spot1  
(Clotho Park) Playback music

Artist	Song Title	Lyric
SEKAI NO OWARI	"ANTI-HERO"	~ Feared and ~
ReoNa	"Scar/let"	~Scarlet~

## Related Research on Music Recommendation

- Song recommendation using chronological topic analysis of lyrics<sup>[1]</sup>
- Note that the lyrics depict the storyline according to the excitement of the song.
  - Recommend songs that are similar to the characteristics of the user's favorite songs
  - Effective as a method to extract the characteristics of music by lyrics



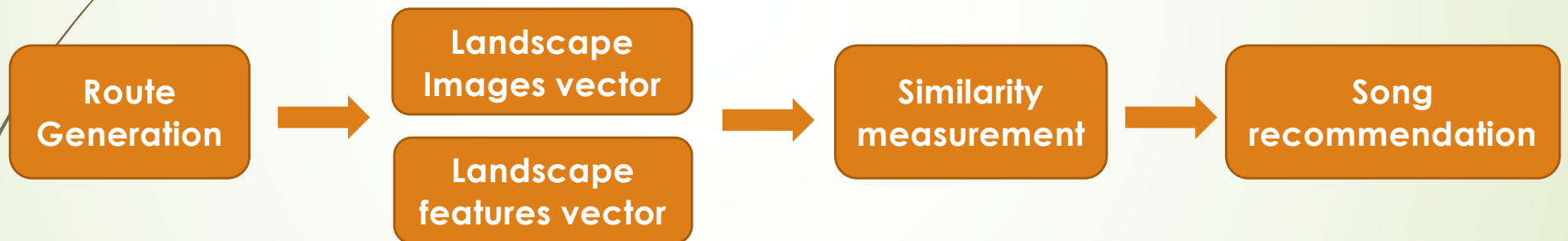
- We have not yet recommended songs according to the surrounding situation.

[1] Construction of a music recommendation system using chronological topic analysis of Inari Tara and Okada Ryutaro, Nakanishi Takafumi, lyrics 13th Forum on Data Engineering and Information Management (DEIM Forum 2021)D24-4,2021

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## Related Research on Recommendation of Music on the Move

- Music playlist recommendation system for scenic routes<sup>[2]</sup>
- Recommend songs based on location



- Consider landscape only

[2] Watanabe Sea, Oku Kenta, music playlist recommendation system suitable for scenic routes  
The 11th DEIM Forum 20219, 2019

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## Purpose of the study

Based on the atmosphere of the spot and the preferences of the user A system that recommends songs by artists similar to the atmosphere of the spot

- Recommend comfortable songs based on user preferences
- By extracting artists who matched the atmosphere at the spot, we recommend songs that match the surrounding situation.

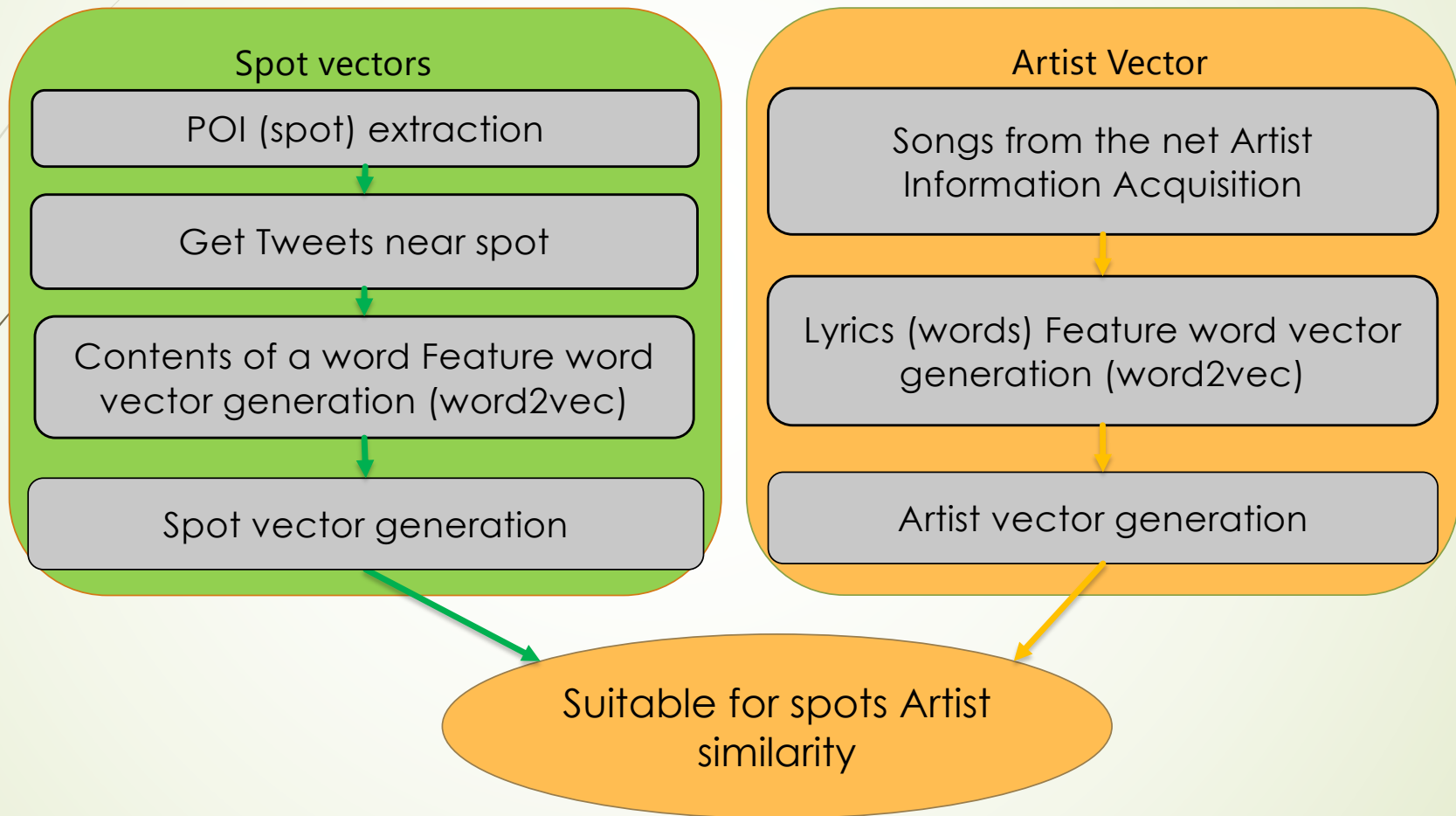


## Music recommendation method based on spot characteristics and user preferences

- ① Extraction of artists suitable for spots from spot vectors and artist vectors
- ② Extraction of artists suitable for user preferences by user vectors
- Extraction of artists suitable for spots and users from ① and ②
- ③ Extraction of music suitable for spots

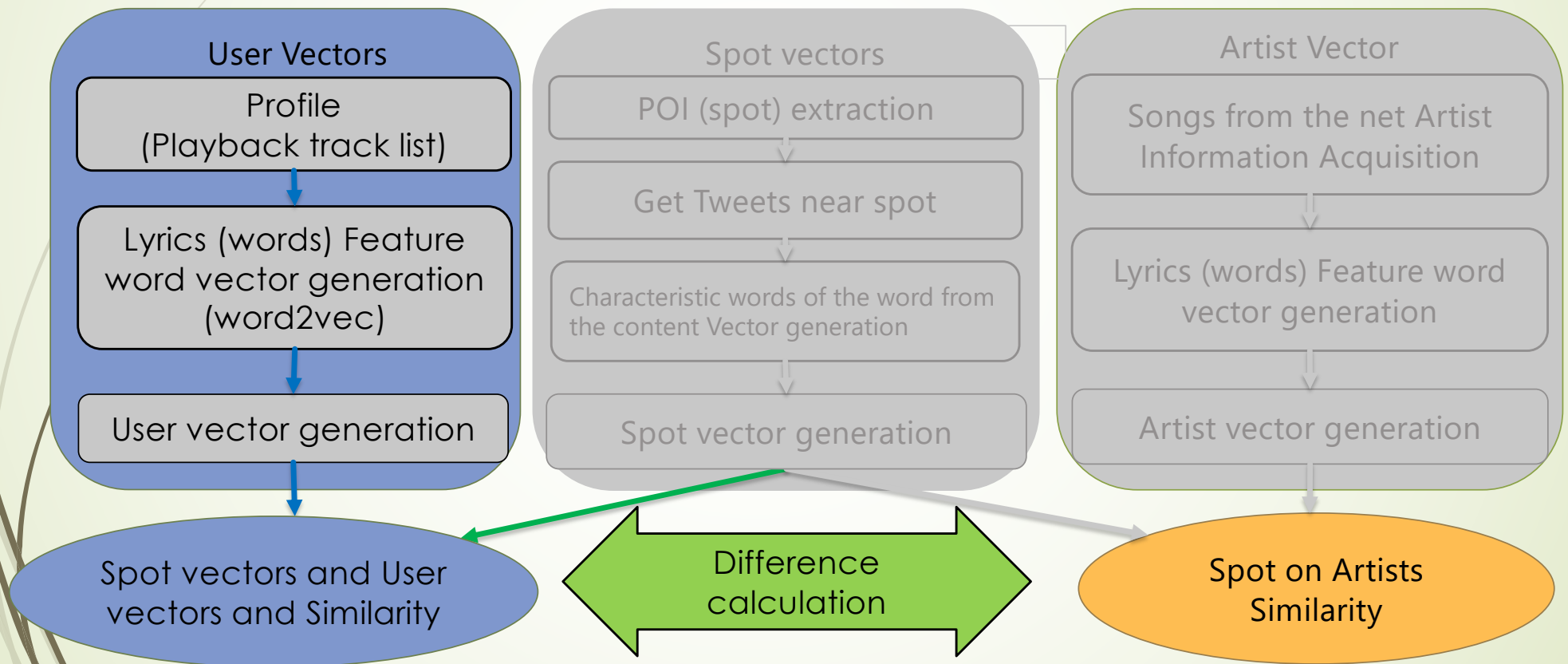


# ① Artist extraction suitable for the spot



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## ② Artist extraction suitable for spots and user preferences



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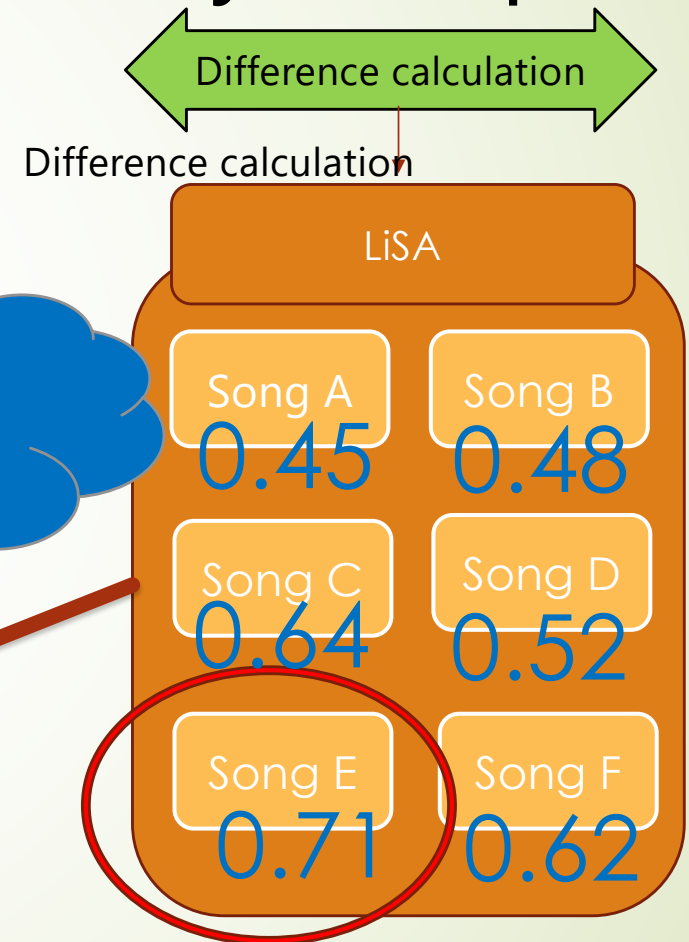
# Extract music recommended by the spot

Table 3 User Profiles

Artist	Song Title
Masumi	"Apple Song"
Mori Calliope	"Off With Their Heads"
Mori Calliope	"Dance Past Midnight"

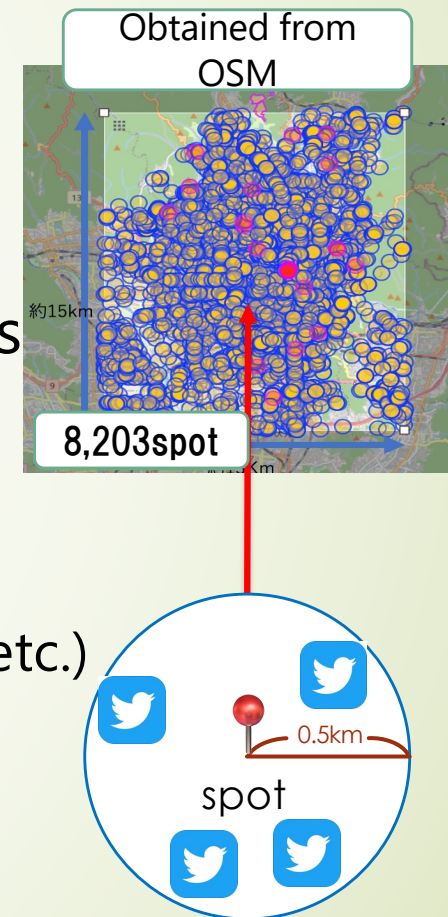
User Vectors

COS similarity  
with each song



# Verification of music recommendation method①

- objective
  - Song verification that matches the atmosphere of the spot
  - Song verification tailored to user preferences
- Verification methods①
  - Target places: Temples, shrines, public institutions, universities, tourist spots
    - 10 locations (Kinkakuji Temple, Kyoto Station, etc.)
  - Songs: 10,053, Artists 100
    - Artists with more than 10 songs



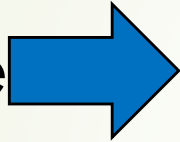
## Verification of music recommendation method②

- Verification methods②
  - Song verification that matches the atmosphere of the spot
    - Calculate nDCG@5 from the results of ranking songs by subjects
  - Song verification tailored to user preferences
    - Evaluate how suitable the chorus of a song is for the user on a Likert scale
    - Calculate the MSE between the normalized value and the proposed method

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## Evaluation method (atmosphere of the spot)

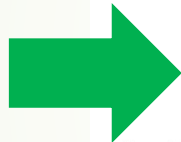
Song Title



a) Song Title : Scar/let

• • • it's alright You can work it out, **Scarlet It's yours to give,**  
**one life to live, complete It's up to you,**  
**don't ever give in to defeat**  
• • •

Lyric



Match the  
atmosphere  
In order of  
presence Ranking



Question (1)-1: Please select a)~e) in the order that matches the atmosphere of "High • View • Rain • Small • Shine" (Skytree). \*

a) songA

b) songB

c) songC

d) songD

e) songE





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## Evaluation method (user preference)

### User watch history

Song Title



Lyric



song1 : Numb

• • • Coz I'm numb inside to everything Wanna run and hide but you're in front of me Push everyone away There's no words for me to say I am over it Coz I'm numb inside to everything Wanna run and hide but you're in front of me Push everyone away There's no words for me to say I am over it I'm numb  
• • •

### Recommended songs

Song Title



Lyric



songA : crossing field

• • • Flying so high up in the sky I'm caught up in a dream My fears they fade away It's my reality And now I know the reason why I've got to make a change Grow stronger every day I need you here with me I'm trapped in the dark but I'll never give in I gotta break free, escape this endless nightmare I won't stop • • •

For user preferences

how much



Evaluate if it is suitable

1



2



3



4



5



Not suitable

suitable



# Verification results (atmosphere of the spot)

Spot	nDCG@5
Kinkakuji Temple	0.867
Ginkakuji Temple	0.955
Kyoto Station	0.954
Kuramaguchi Station	0.934
Kyosann	0.891
Sky tree	0.92
Tokyo Tower	0.889
TDL	0.896
USJ	0.87
average	0.9

	Ginkakuji Temple	Kyoto Station	Sky tree
spot	Temple	Shinkansen	High
Characteristic words	Old <b>Fall Foliage</b>	Kyoto pleasant	Rain <b>Night view</b>
Top Songs Lyric words	<b>Flower</b> <b>beautiful</b> color	<b>Trip</b> Night view star	<b>Prospect</b> song tomorrow

- Good because the lyrics contained words with a high degree of similarity for each feature in the spot
- Example) Autumn leaves: Flowers High: Perspective

# Verification results (user preferences)

Recommended song	words total	MSE
"kinmokusei"	8	0.382
"Lotus"	9	0.291
"kiminiaetara"	11	0.244
"huyutubaki"	4	0.445
"orenjinoyuuhi"	8	0.006
"Pasute-ji"	13	0.200
"yuunagi"	15	0.198
"orasionn"	4	0.561
"hana"	9	0.337
average	8.8	0.292

再生履歴 楽曲特徴語	orenginoy uuhi	Pasute-ji	yuunagi
Flower Shine gentle	tear Smile future	tomorrow song prospect	beautiful Shine sky

- If the total number of feature words is small, the MSE will be high
- The average MSE of songs with a total number of feature words is 0.214
  - Valid for songs with a total number of feature words of 10 or more
- Some words are similar to the characteristic words in the watch history

## Consideration

- In the verification of the atmosphere of the spot, words similar to the characteristic words of the spot are also included in the recommended music.



The average nDCG@5 is 0.9, confirming the effectiveness

- In the verification of user preferences, songs with a small total number of characteristic words have a high MSE.
- It is difficult to judge whether songs with few characteristic words are suitable for user evaluation.



Valid for songs with a total number of feature words of 10 or more

## Summary

- Music recommendation considering the atmosphere of the spot and user preferences
- Verification of music recommendation method for spots
  - Extract songs suitable for the spot from tweets and lyric information around the spot
  - Confirmation of effectiveness from the nDCG@5
- Verification of music recommendation method for user preferences
  - If the total number of feature words is small, the MSE is high
- Future Challenges
  - Consider the total number of characteristic words and recommend songs