Geovisualizations of Demographic Disparities of Public Sentiment toward Covid-19 through Social Media

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Covid-19 and Mental Health

COVID-19 pandemic triggers
25% increase
in prevalence of anxiety and
depression worldwide in 2020.

**World Health
Organization**

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Social Media and Demographic Bias

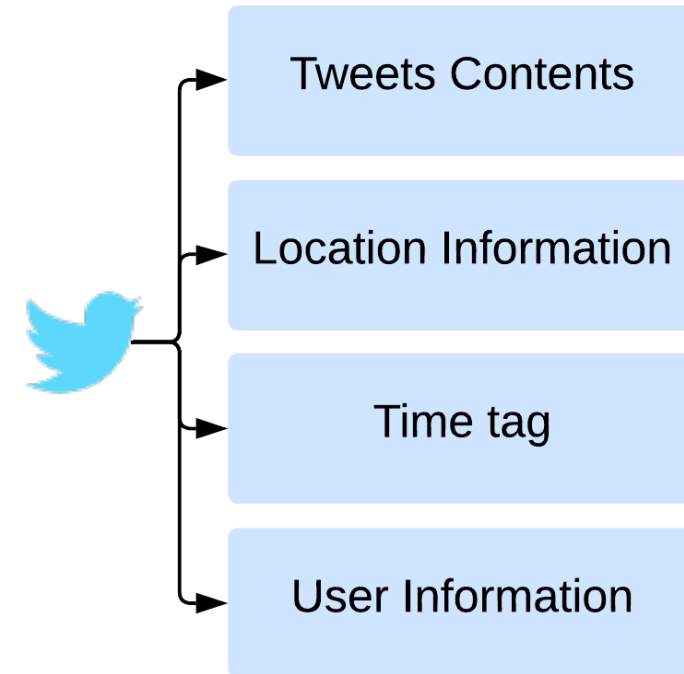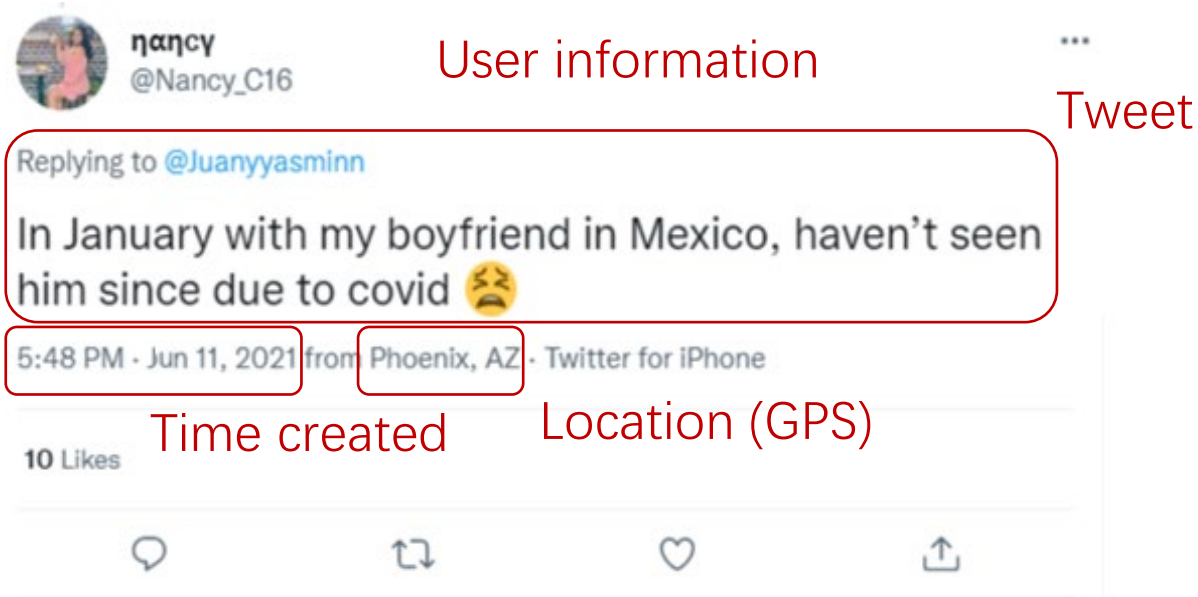Twitter data are biased toward younger, well-educated, and wealthier population living in urban communities.

(Blank 2017; Jiang, Li, and Ye 2018).

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Research Questions

(1) What are the geographical and demographic disparities of public sentiment toward Covid-19 reflected on social media?

(2) How can we alleviate the demographic bias within social media to fairly evaluate public sentiment toward specific topics or during hazardous events, e.g., Covid-19?

Twitter data

User information

Tweet

Time created

Location (GPS)

Tweets Contents

Location Information

Time tag

User Information

4,822,802 Covid-19 tweets from public users in 2020 and 2021.
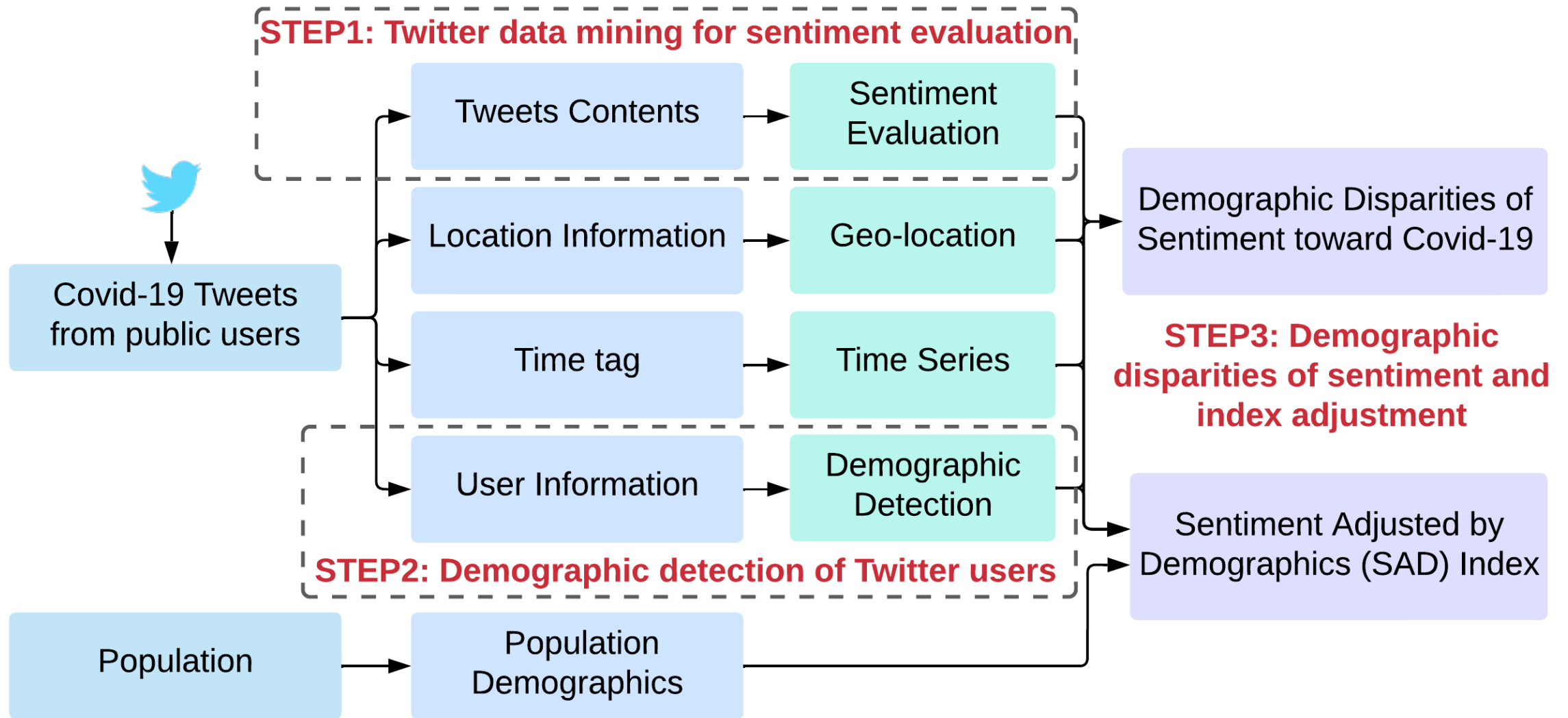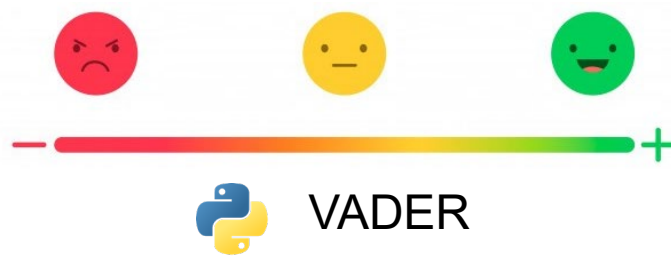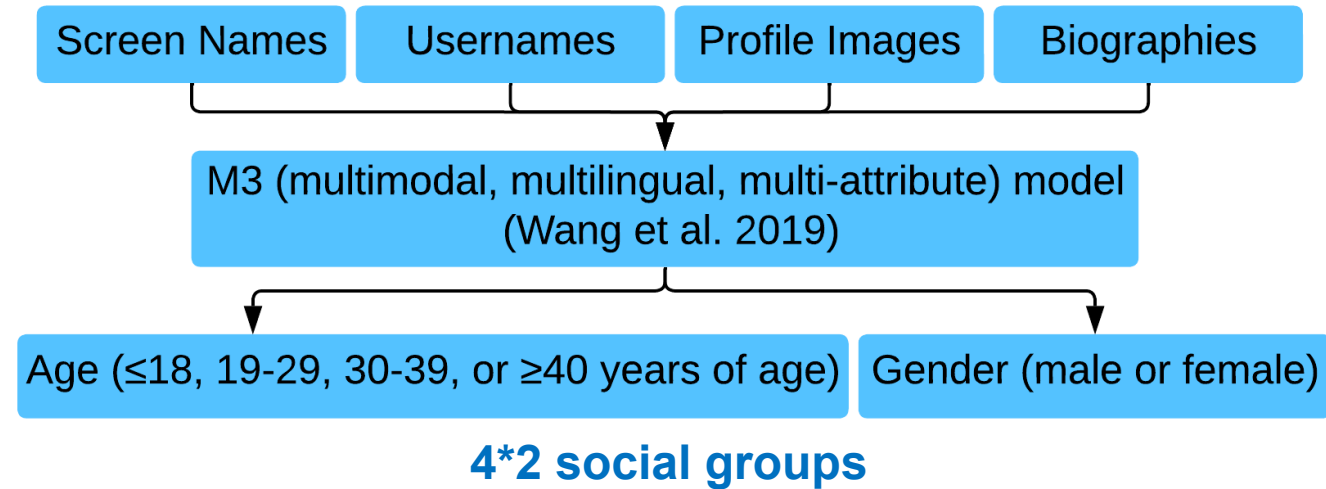
Workflow

Figure 1. Workflow of this study.

Method

STEP1: Twitter data mining for sentiment evaluation

VADER

STEP2: Demographic detection of Twitter users

Screen Names	Usernames	Profile Images	Biographies

M3 (multimodal, multilingual, multi-attribute) model
(Wang et al. 2019)

Age (≤18, 19-29, 30-39, or ≥40 years of age)	Gender (male or female)

4*2 social groups

STEP3: Demographic disparities of sentiment and index adjustment

Sentiment Adjusted by Demographics (SAD) index:

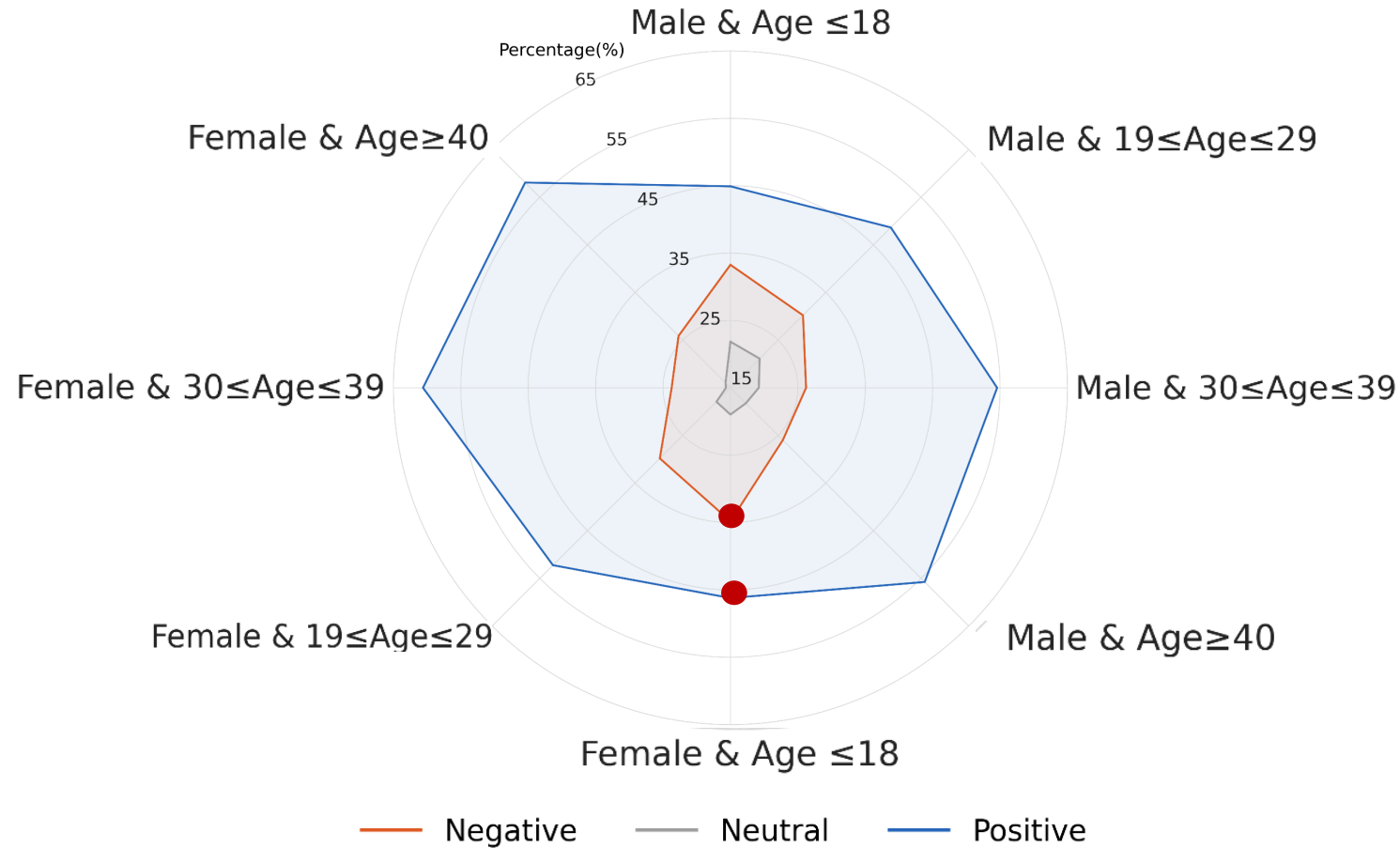(1) $\quad w_i = \dfrac{\% \, \text{Group}_i \ \text{of population}}{\% \, \text{Group}_i \ \text{of Twitter users}}$

(2) $\quad SAD = \dfrac{\sum\limits_{i=1}^{8} \# \, \text{Negative Users in Group}_i * w_i}{\sum\limits_{i=1}^{8} \# \, \text{Users in Group}_i * w_i}$

Results

Part 1

Geographic and Demographic Disparities of public sentiment

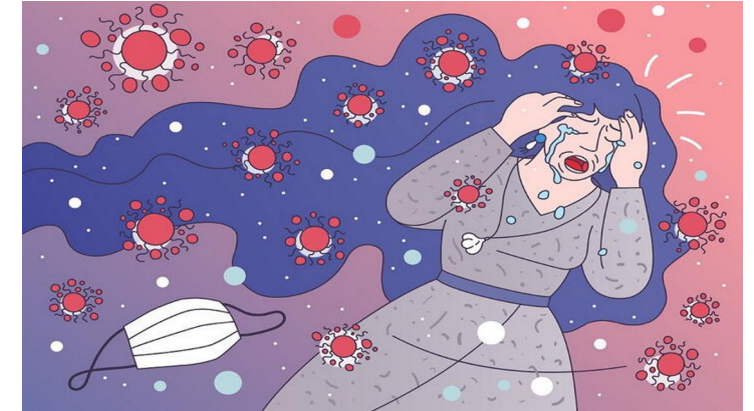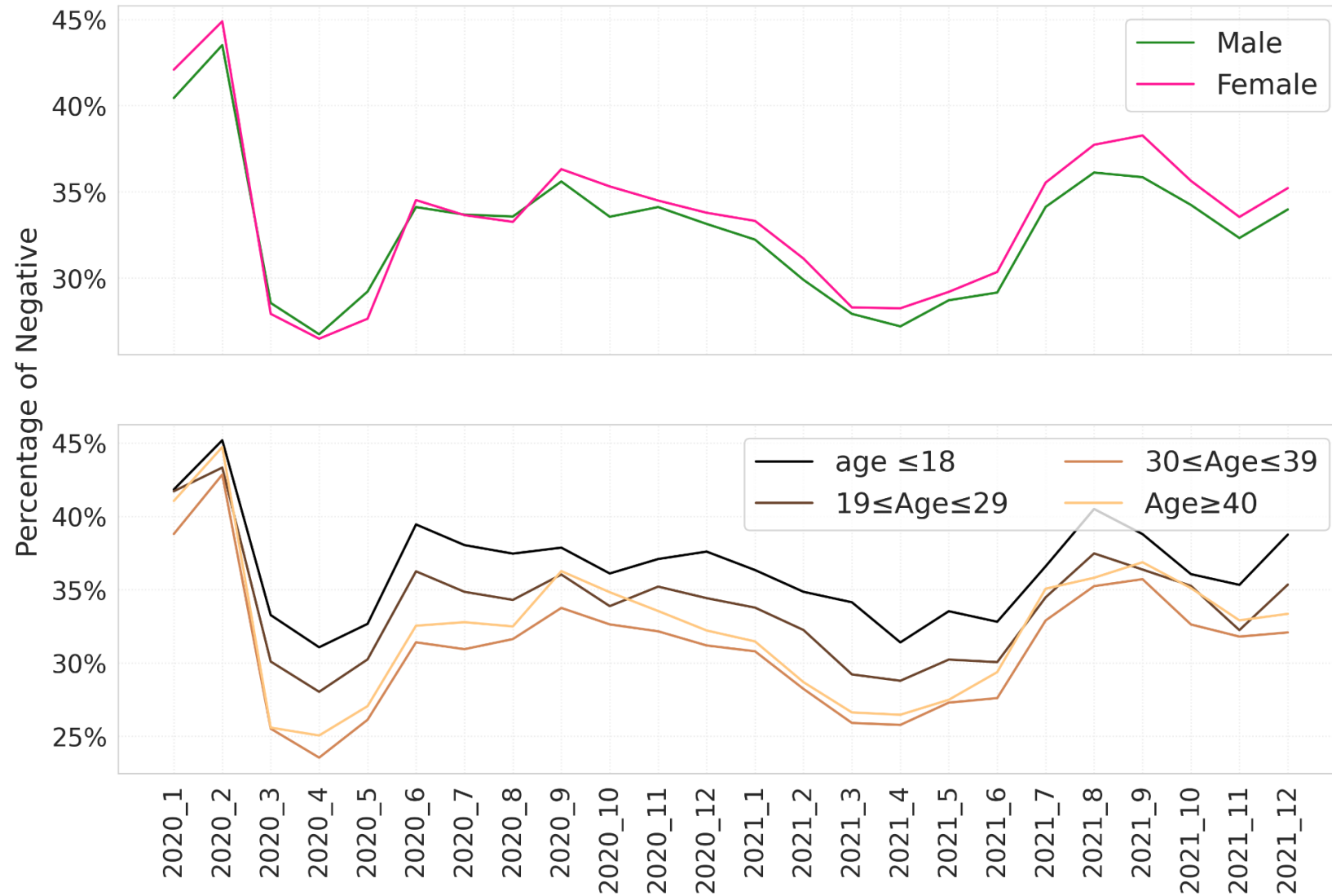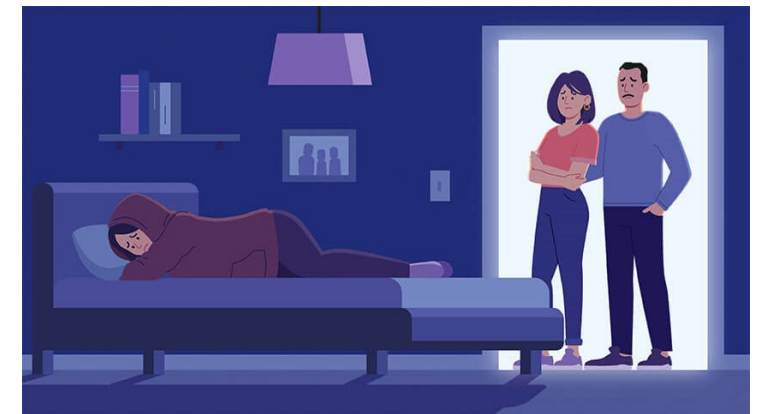# Result₁: Demographic Disparities of public sentiment

Figure 2. Percentages of negative, neutral, and positive Twitter users in eight social groups in the U.S.

34.82%

Female Twitter users under or equal the age of 18 suffered a highest percentage of negative sentiment.

Result2: Monthly Demographic Disparities of public sentiment

Figure 3. Temporal trends of percentages of negative Twitter users in different ages and gender groups in the U.S.

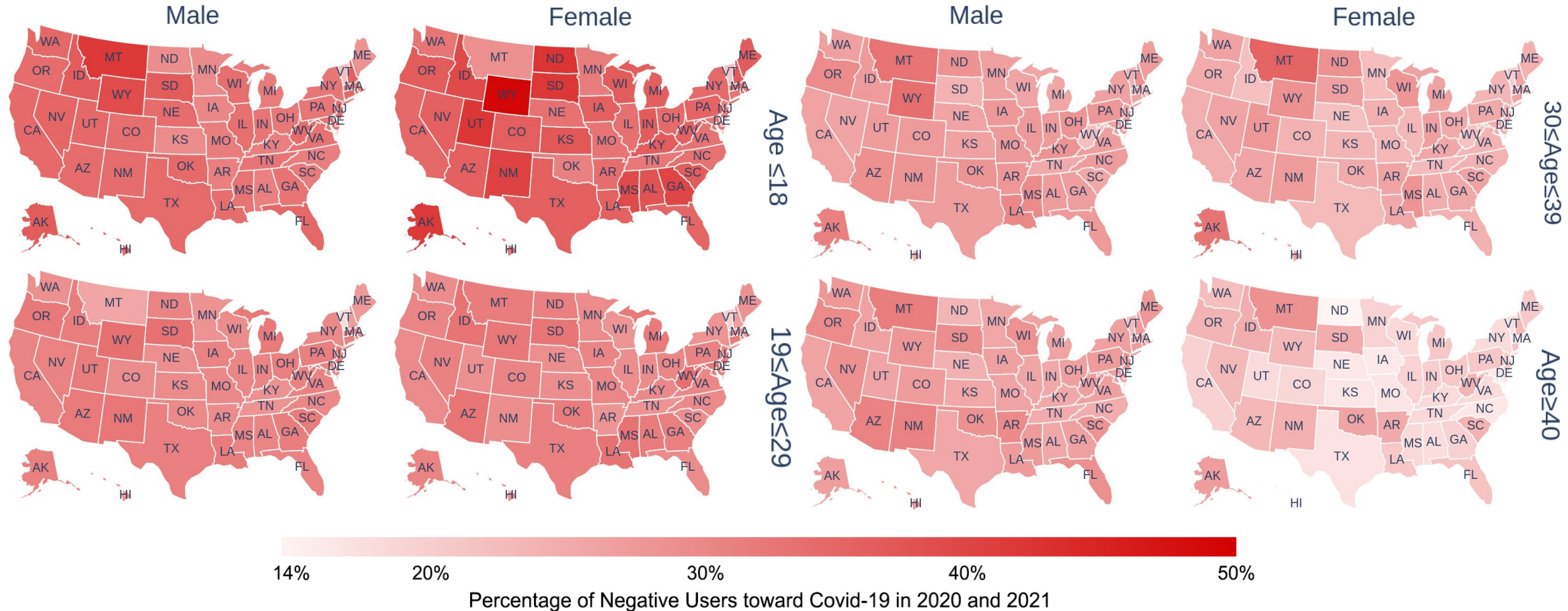# Result3: Geographic and Demographic Disparities of public sentiment

Figure 4. Percentages of negative Twitter users toward Covid-19 in different social groups at the state level in the U.S. in 2020 and 2021.

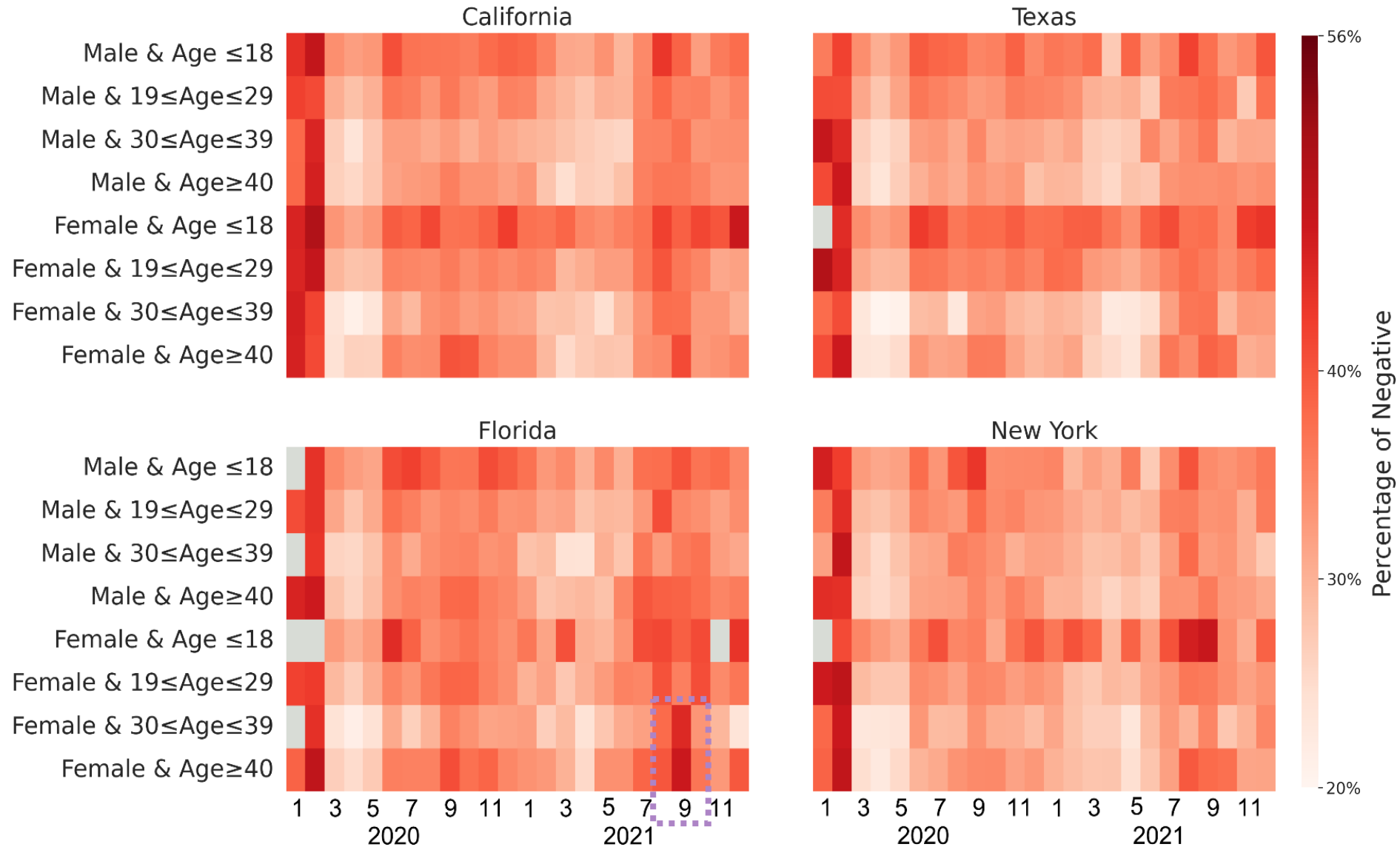# Result4: Geographic and Demographic Disparities of public sentiment

Figure 5. Monthly percentages of negative Twitter users toward Covid-19 in different social groups in four most populous states.

Part 2
Sentiment adjusted by demographics (SAD)
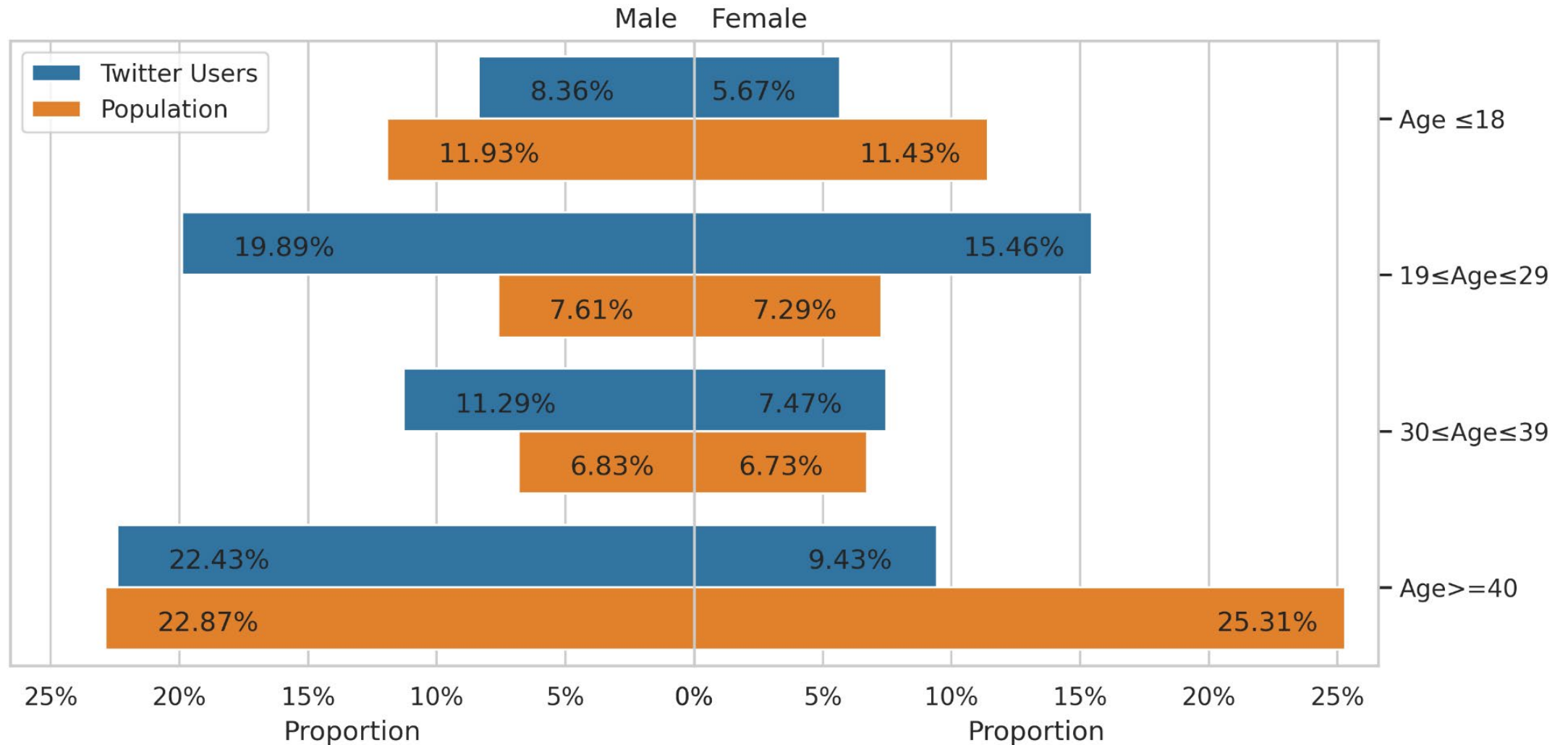
Result5:Demographic bias of Twitter data

Figure 6. The proportions of different social groups at the national level. (Twitter users only include Twitter users who tweeted about Covid-19 in the U.S. in 2020 and 2021).

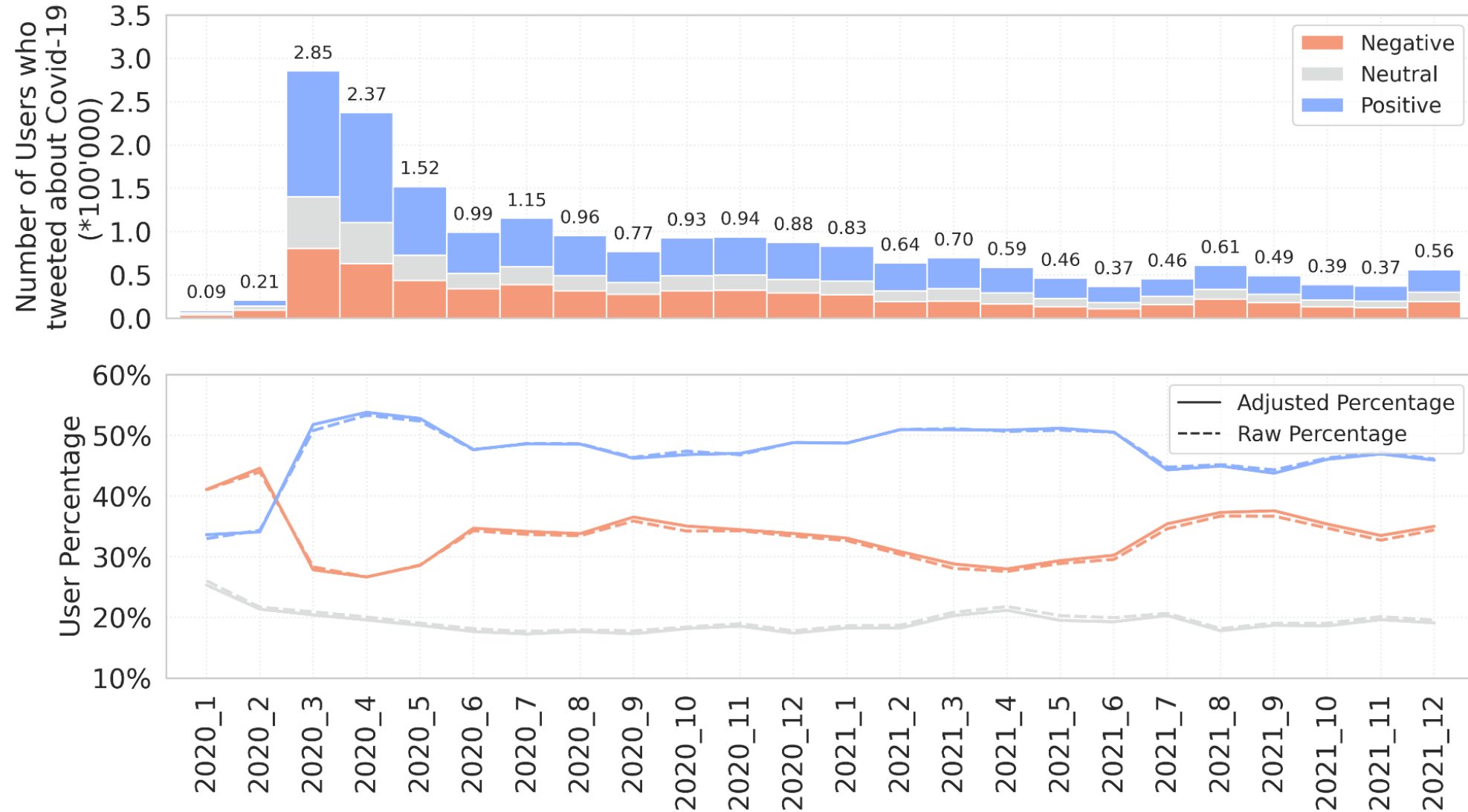# Result6:Temporal trends of adjusted % of users with different sentiment

Figure 7. National temporal trend of the number of Twitter users tweeting about Covid-19, raw percentages and adjusted percentages of users with positive, neutral, and negative sentiment toward Covid-19 in the U.S. in 2020 and 2021.

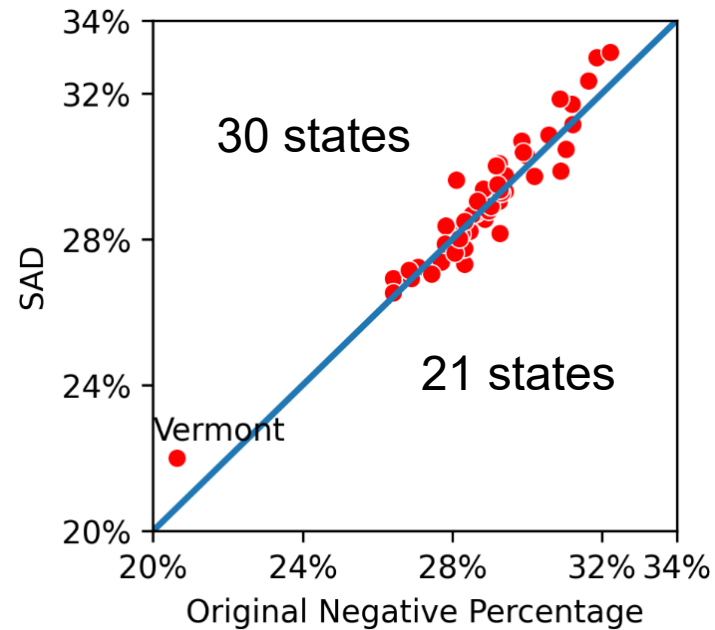# Result7: Map of adjusted % of users with different sentiment

Figure 8. The comparison of original percentages of negative Twitter users toward Covid-19 and the SAD index.
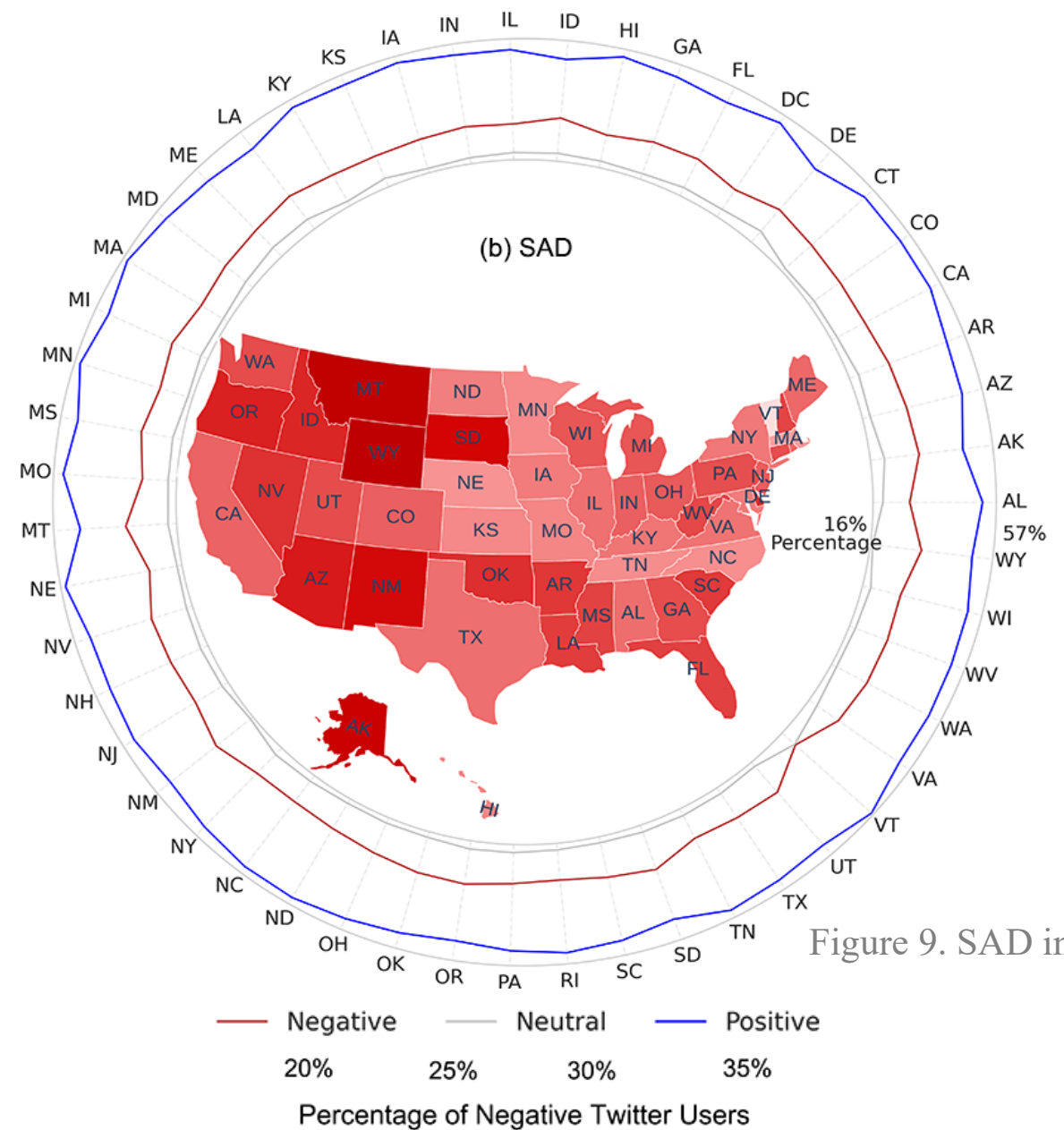

Figure 9. SAD index.

❖ **Female, age≤18** groups are more vulnerable to suffer negative sentiment toward Covid-19.

❖ According to the SAD index, the most negative state toward Covid-19 on Twitter is **Wyoming.**

❖ The demographical bias of Twitter is not an significant issue for public sentiment analysis at the national level. However, **demographical bias should be considered in state level analysis**.

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Thank you!

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