Utilizing User-Reviews on Google Play Store
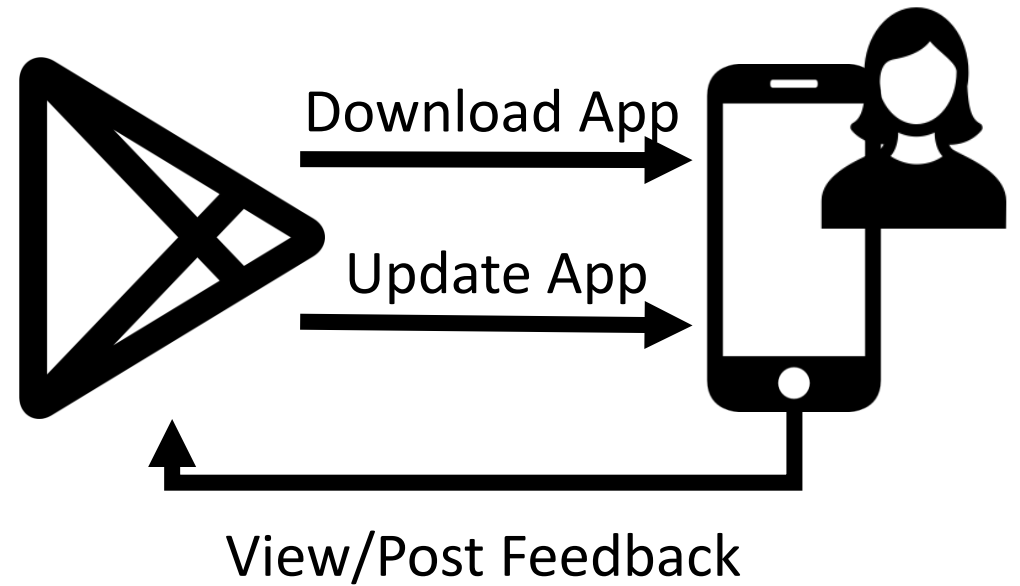
Ehsan Noei

Kelly Lyons
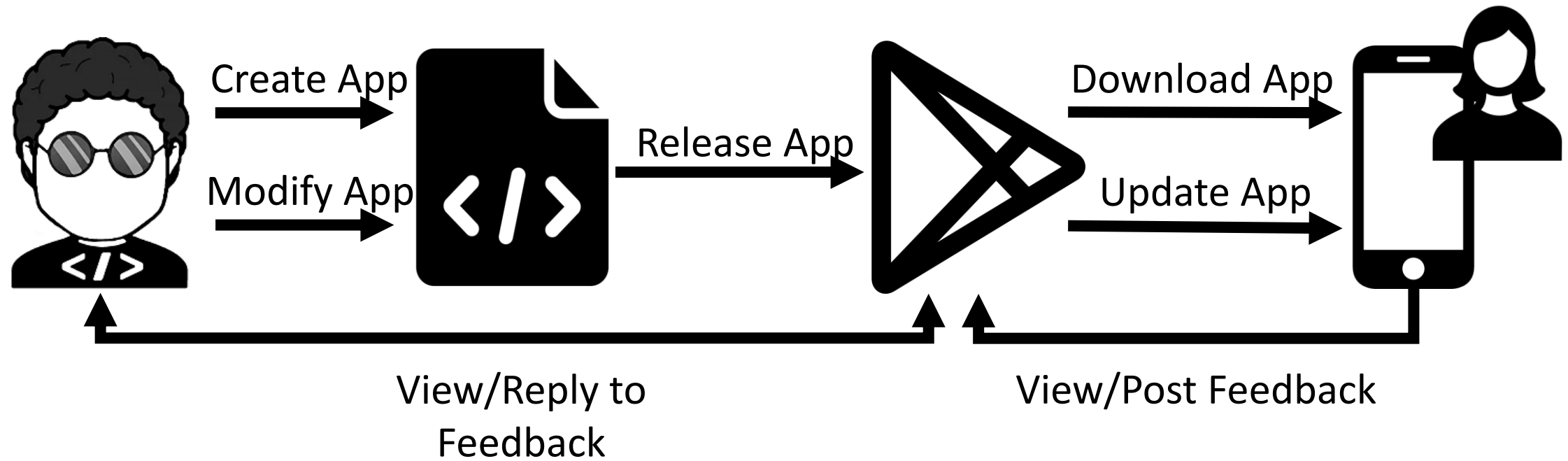
2|
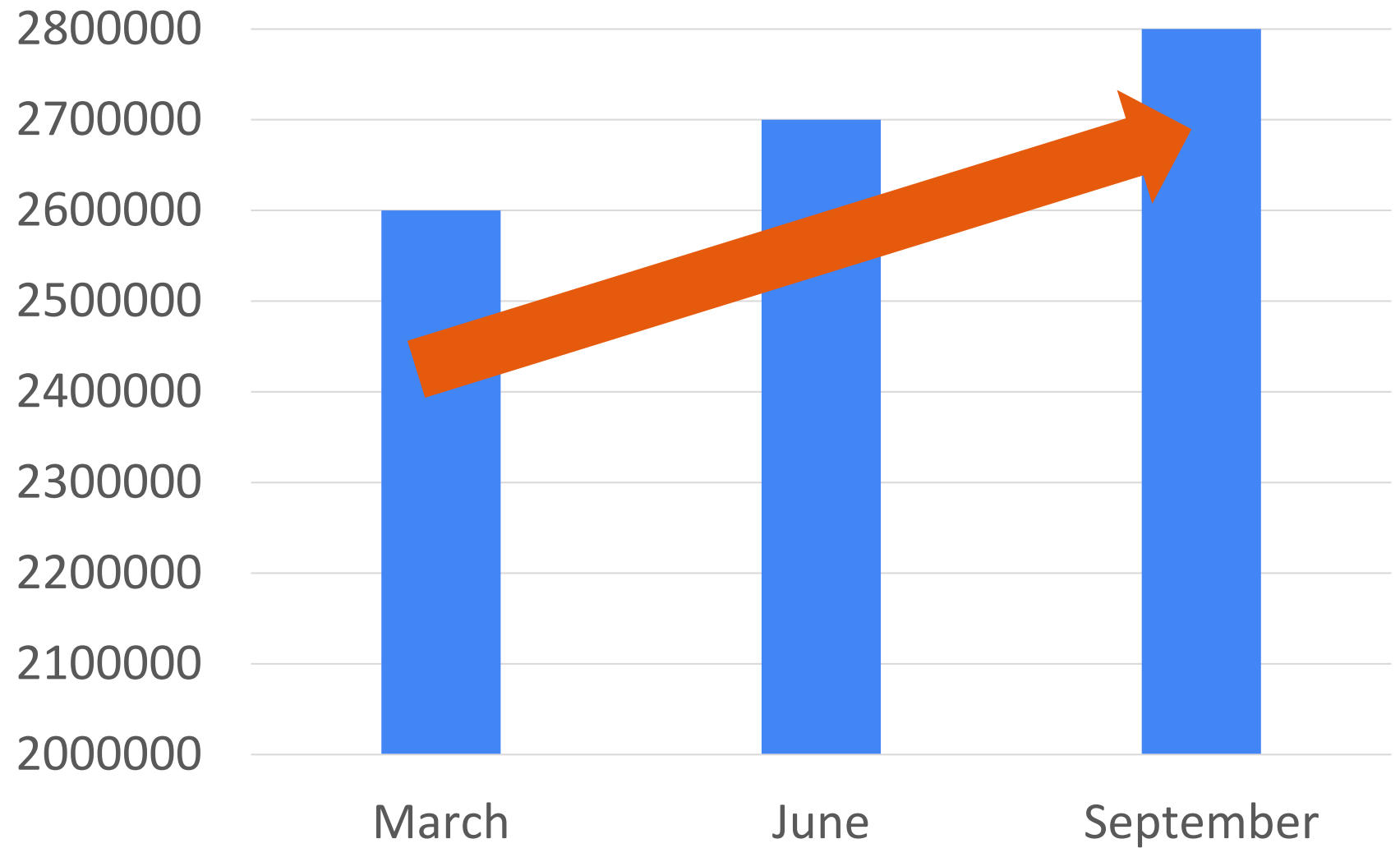
3 | Over 2.8 Million Android Apps

Download App

Update App

View/Post Feedback

4 | Users and Developers Interaction

Create App

Modify App

Release App

Download App

Update App

View/Reply to
Feedback

View/Post Feedback

Users and Developers Interaction

6 | Goal: Success!

Improving star-ratings

Increasing number of downloads

Better ranks

Goal

Improving star-ratings

Increasing number of downloads

Better ranks

61% of Android apps (out of 900) lost their ranks in Google Play Store in a two-year study (Noei *et al.* (2018)).

Goal

9| Rank

Rank and Stars

★★☆☆☆ August 21, 2019

a big problem in this application in English Language, you didn't fix this problem in the content,games and even when we send feedback to the admins, they say write in Russian to understand you!!!!!. There are many many customers subscribe everyday so try to fix this problem

Odnoklassniki Ltd September 1, 2019

Thank you for reaching out! We have forwarded your complaint to our developers and they will think it over. We hope that the situation will change in the nearest future. OK.ru Customer Support Team

11 | User-Review

★★☆☆☆ August 21, 2019

👍 55

a big problem in this application in English Language, you didn't fix this problem in the content,games and even when we send feedback to the admins, they say write in Russian to understand you!!!!!. There are many many customers subscribe everyday so try to fix this problem

Odnoklassniki Ltd September 1, 2019

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12 | User-Review

Bug Reports

Feature Requests

User Experience

Test Cases

Hardware Compatibility

Users' Technical and Non-Technical Demands

User Priorities

13 | User-Reviews Contain Useful Information

Bug Reports
Feature Requests
User Experience
Test Cases
Hardware Compatibility
Users' Technical and Non-Technical Demands
User Priorities

14 | User-Reviews Contain Useful Information

A ★★ ★ ★ ★ August 21, 2019

👍 55

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15 | User-Review

Star-Rating

Photo Credit: https://www.shutterstock.com

Disadvantages

Vague meaning

    Different interpretations

Inconsistencies with user-reviews
(Noei *et al.* (2018))

Can endanger app survival

    Resilient to change (Ruiz *et al.* (2016))

Advantages

Easy to use

Easy to summarize and visualize

17 | Star-Rating

Disadvantages

Vague meaning
> Different interpretations

Inconsistencies with user-reviews
(Noei *et al.* (2018))

Can endanger app survival
> Resilient to change (Ruiz *et al.* (2016))

Star-Rating

> *AMAZING! THIS APP IS THE BEST AND ONE OF MY FAVORITES*

> *TERRIBLE THIS IS SO BAD MANY GLITCHES THIS GAME MAKES ME WANT TO THROW UP*
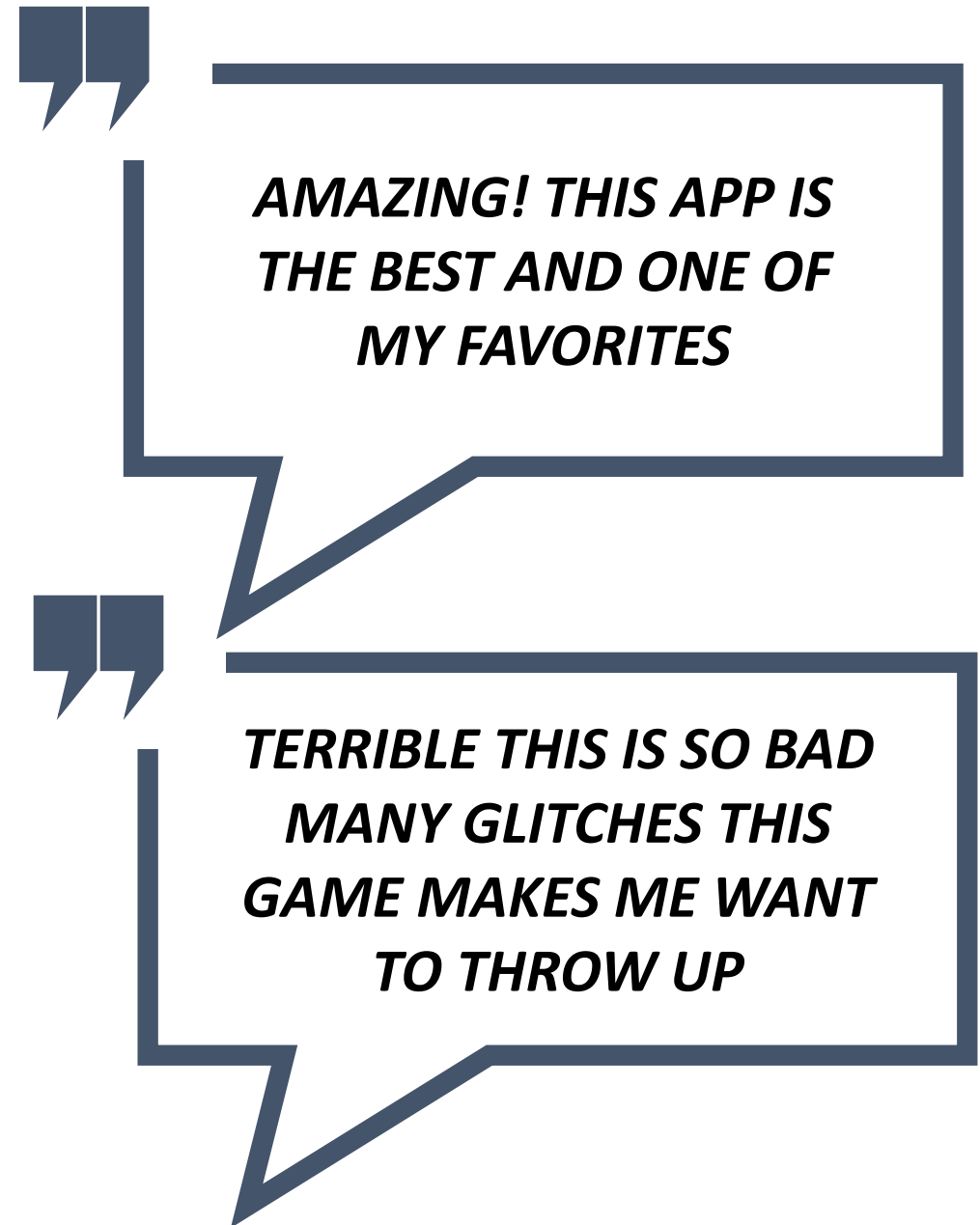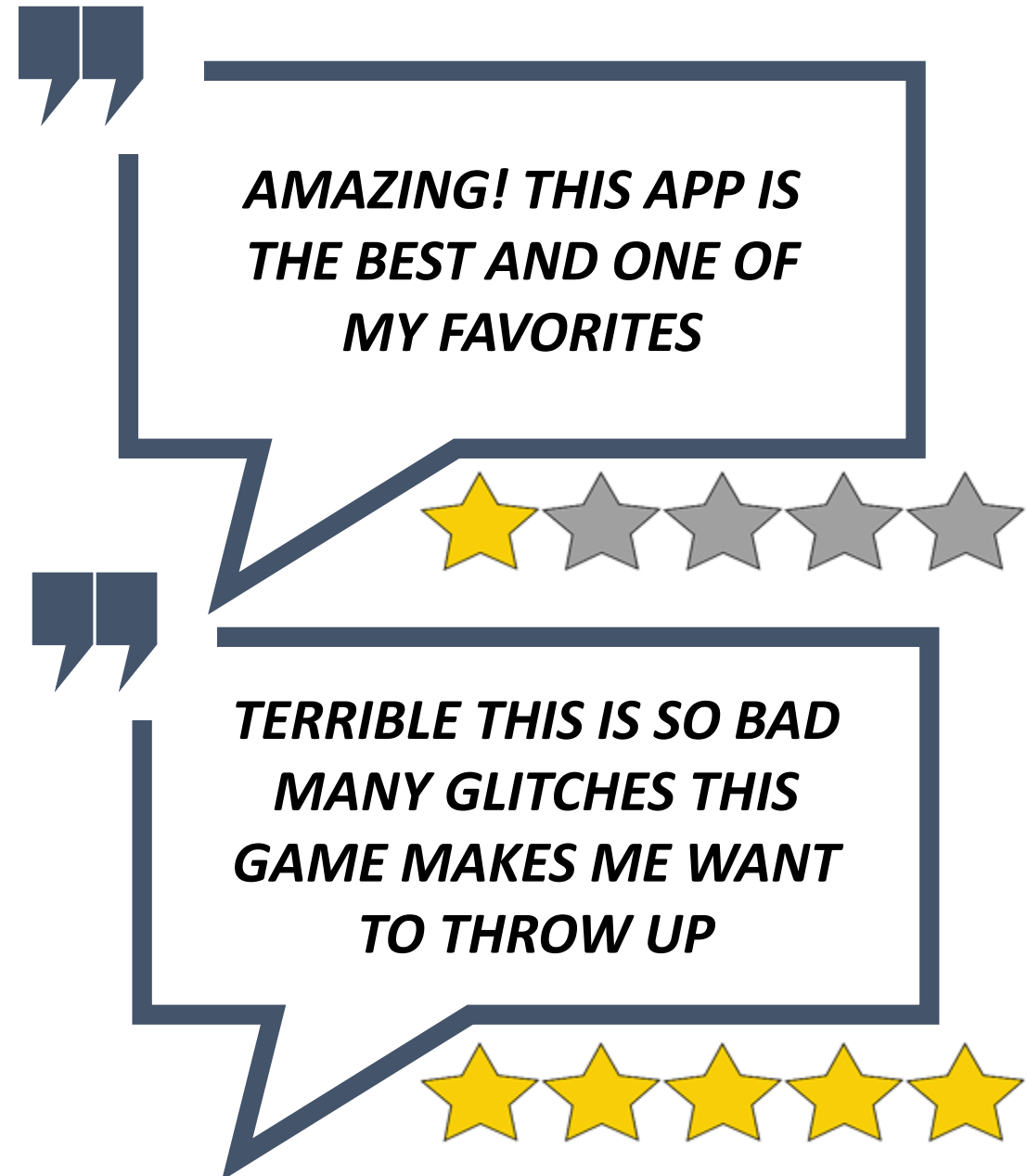
Disadvantages

Vague meaning
    Different interpretations

Inconsistencies with user-reviews
(Noei *et al.* (2018))

Can endanger app survival
    Resilient to change (Ruiz *et al.* (2016))

19| Star-Rating
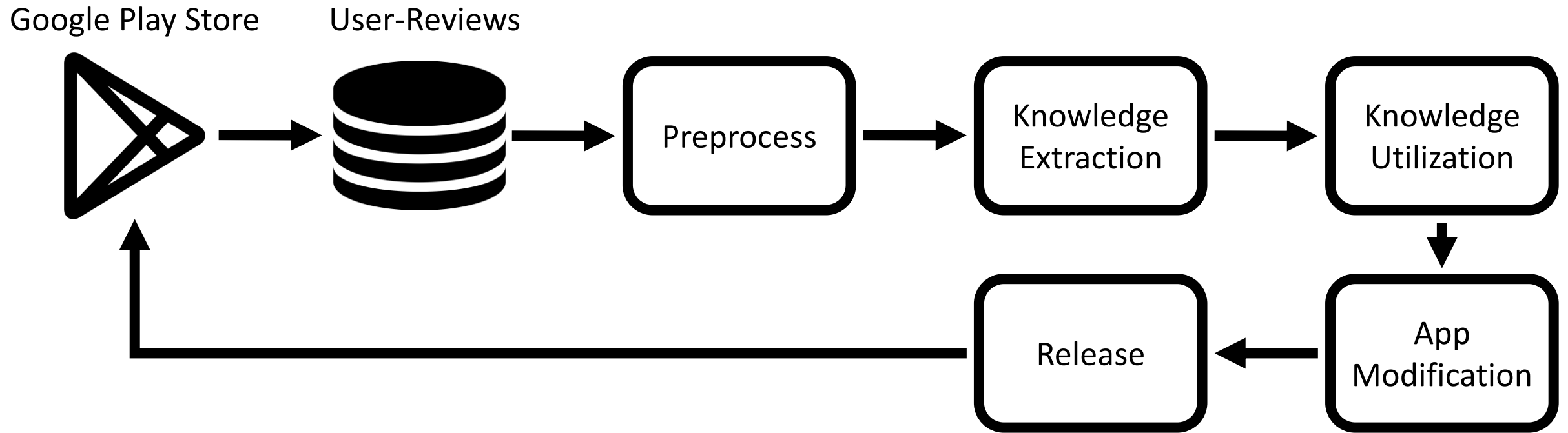
A ★★ ★ ★ ★ August 21, 2019

55

a big problem in this application in English Language, you didn't fix this problem in the content, games and even when we send feedback to the admins, they say write in Russian to understand you!!!!!. There are many many customers subscribe everyday so try to fix this problem

Odnoklassniki Ltd September 1, 2019

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20 | Developer Response

38.7% of negative user-reviews (of 10,713 apps top apps) turned into positive ones after getting a proper response from developers explaining that they have addressed the issue or resolved the problem (McIlroy et al. (2015)).

Developer Response

Google Play Store   User-Reviews   Preprocess → Knowledge Extraction → Knowledge Utilization → App Modification → Release

App Development Paradigm

+50 research papers

20 included in the paper

Survey

24 | Data Collection

informal piece of text

usually suffer from grammatical issues and typos

no standards or consistent choices of words and terms

negations

usually very short

25 | User-Review

Preprocessing

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

Coreference Resolution

Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

27| Preprocessing

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

Coreference Resolution
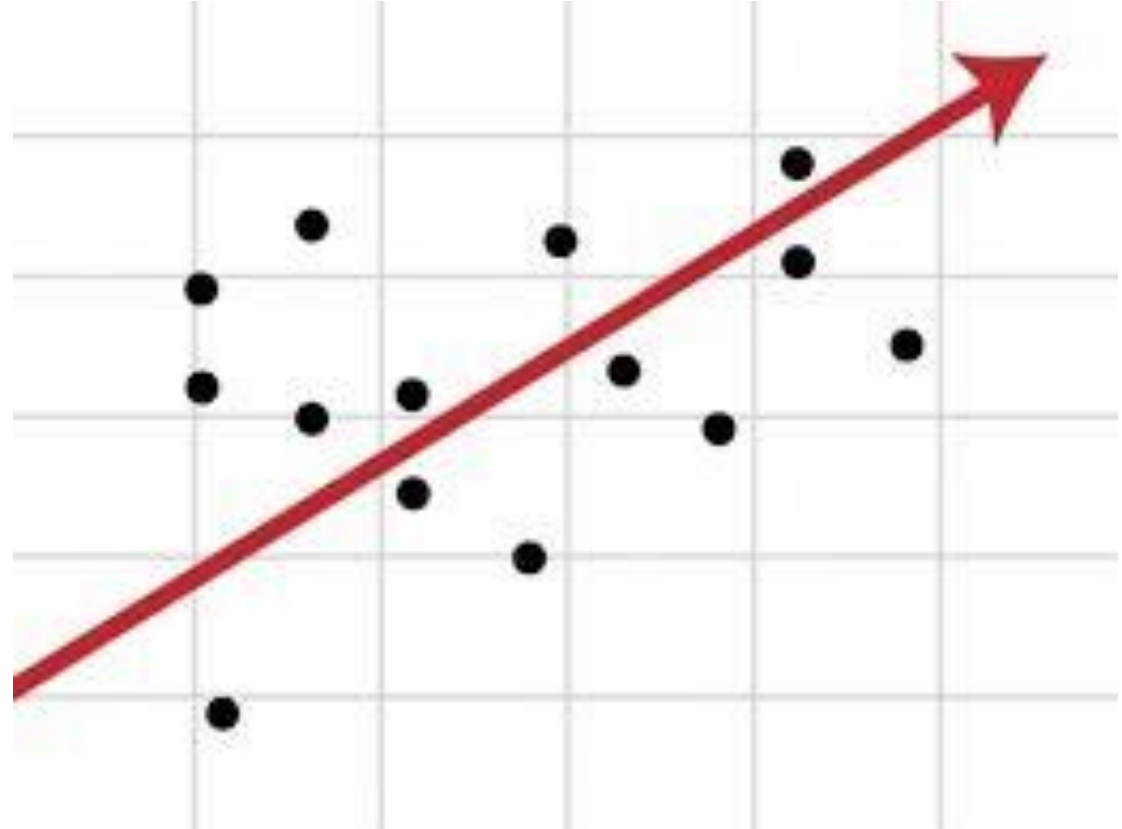
Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

| Inconsistent User-Reviews

Regression Model (Fu *et al.* (2013))

Predict star-ratings

Compare with actual star-ratings

Inconsistent User-Reviews

Sentiment Analysis (Noei *et al.* (2018))

Sentiment: [-5, +5]

Star-Rating: {1, 2, 3, 4, 5}

Inconsistent User-Reviews

Sentiment Analysis (Noei *et al.* (2018))

Sentiment: [-5, -1), [-1, +1], (+1, +5]

Star-Rating: [1, 2], 3, [4, 5]

31 | Inconsistent User-Reviews

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

Coreference Resolution

Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

32 | Uninformative User-Reviews

DISAPPOINTED WITH THE FULL VERSION. I LOVE THIS APP AND I HAVE BEEN USING IT FOR A LONG TIME, SO I DECIDED TO GET THE FULL VERSION BUT SOME FEATURES DISAPPEARED, LIKE THE POSSIBILITY TO ADD MORE PHOTOS TO EDIT AT THE SAME TIME...
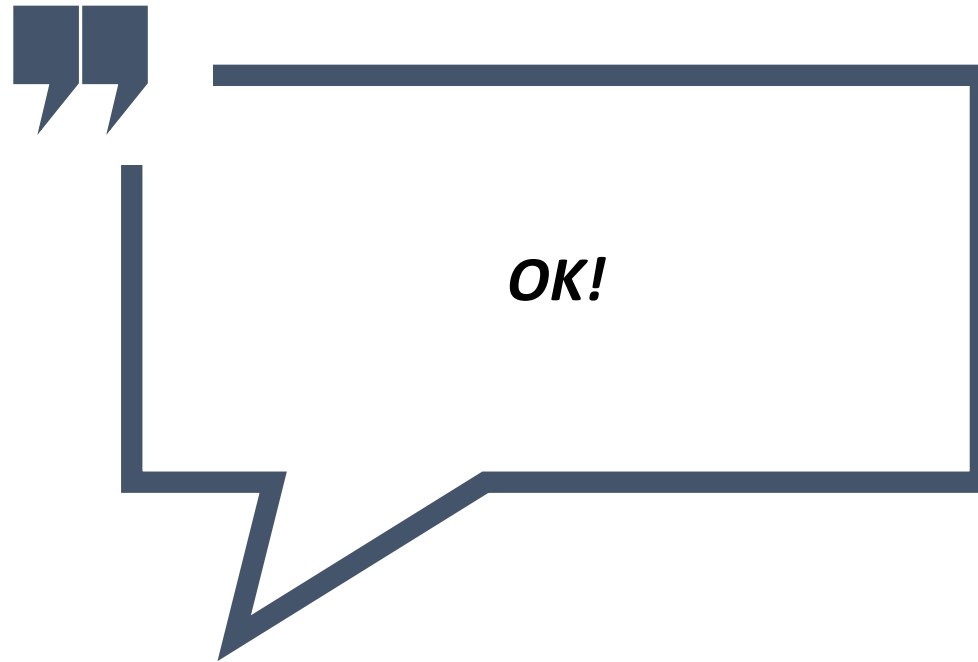
Informative User-Review

OK!

| Uninformative User-Review

OK!

★★★★★

35 | Uninformative User-Review

AR-Miner (Chen *et al.* (2014))

CLAP (Villarroel *et al.* (2016))

Linguistic Rules (Noei *et al.* (2019))

Uninformative User-Reviews

AR-Miner (Chen *et al.* (2014))

Naïve Bayes Classifier

CLAP (Villarroel *et al.* (2016))

Linguistic Rules (Noei *et al.* (2019))

| Uninformative User-Reviews

AR-Miner (Chen *et al.* (2014))

CLAP (Villarroel *et al.* (2016))
    cluster user-reviews in groups of feature requests and bug reports

Linguistic Rules (Noei *et al.* (2019))

Uninformative User-Reviews

AR-Miner (Chen *et al.* (2014))

CLAP (Villarroel *et al.* (2016))

Linguistic Rules (Noei *et al.* (2019))

#	Rule
1	`<pronoun>?` `<App|Application>?` `<verb>` `<just,really,very,not>*` `<adjective>?` `<adverb>?`
	Note. In this rule, $verb \in \{work, is, run\} \cup \{describing\ verbs\}$, including all the variants of a verb. For example for *work*, we considered *works, does not work, is working, has worked, has been working,* and *has not worked.* Describing verbs are the verbs that demonstrate users' feelings, such as *rocks* and *stinks.*
2	`<just,not,article,really,very>*` adjective `<App|Application>?`
	Note. Articles include *a, an,* and *the.*
3	`<Appreciation>`
	Note. The *appreciation verbs* are *thanks, thank you, thanks a lot, thanks so much, thank you so much,* and *thank you very much*

39 | Uninformative User-Reviews

AR-Miner (Chen *et al.* (2014))

CLAP (Villarroel *et al.* (2016))

Linguistic Rules (Noei *et al.* (2019))

Uninformative User-Reviews

Photo Credit: https://pixabay.com/illustrations/signpost-road-signs-sign-post-2030780/

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

Coreference Resolution

Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

41 | Correcting Typos

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

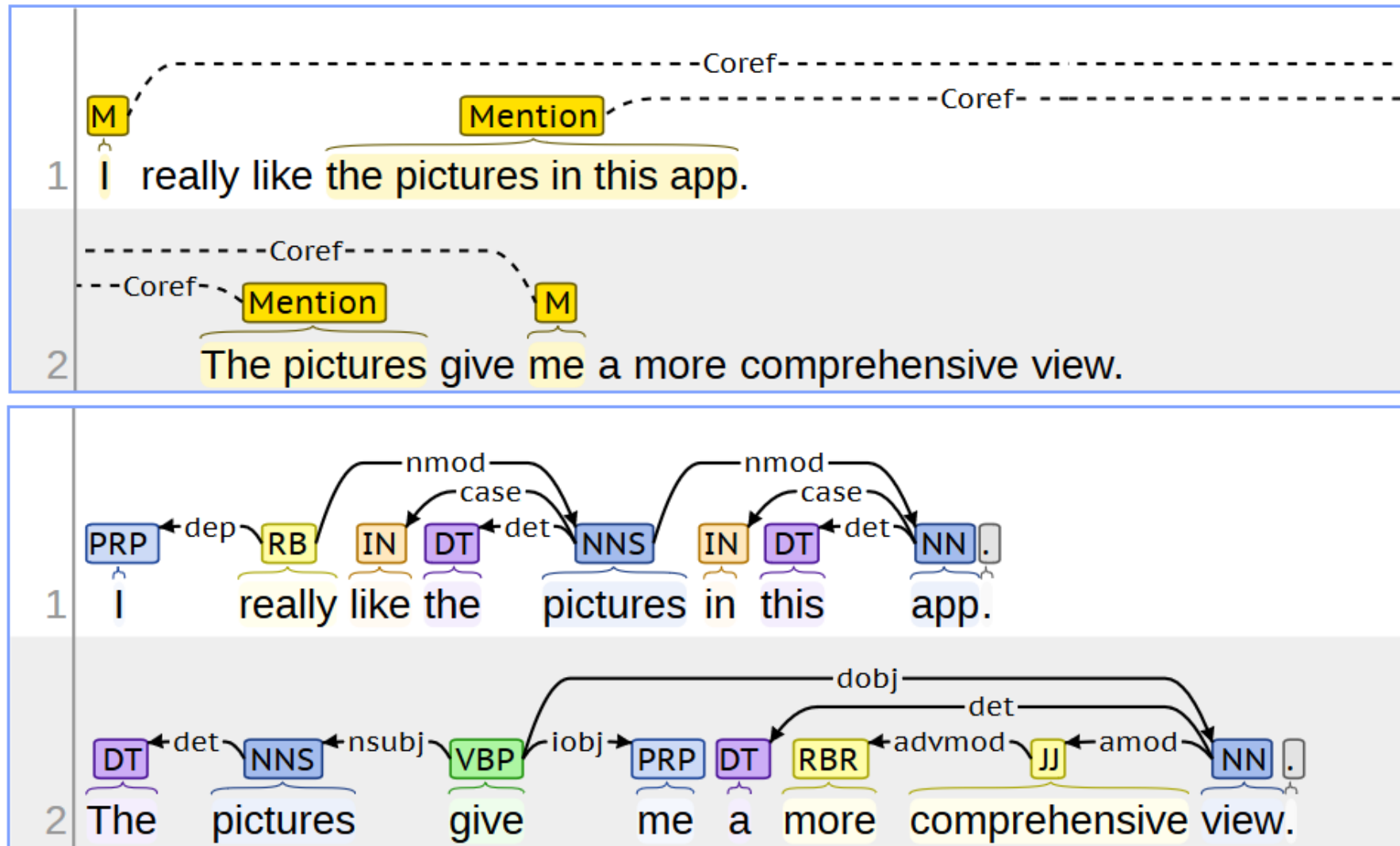Correcting Typos

Actual Typos

Internet Slangs/Terms

Coreference Resolution

Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

42| Correcting Typos

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

Actual Typos

Internet Slangs/Terms

Coreference Resolution

Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

W8! YOU HAVENT IMPROVED MESAGING!

43 | Correcting Typos

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

    Actual Typos

    Internet Slangs/Terms

Coreference Resolution

Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

W8! YOU HAVENT IMPROVED MESAGING!

44 | Correcting Typos

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

Coreference Resolution

Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

45 | Coreference Resolution

Coreference Resolution

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

Coreference Resolution

Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

47 | Labeling and Annotation

> *YOU CAN ONLY EDIT PHOTOS BUT WHENEVER I WANTED TO EDIT VIDEOS I CLICKED ON IT AND THE APP STOPPED WORKING. I'VE TRIED IT MULTIPLE TIMES AND IT STILL DOESN'T WORK*

Labeling and Annotation

> *YOU CAN ONLY EDIT PHOTOS* BUT WHENEVER I WANTED TO EDIT VIDEOS I CLICKED ON IT AND THE APP STOPPED WORKING. I'VE TRIED IT MULTIPLE TIMES AND IT STILL DOESN'T WORK

Labeling and Annotation

McIlroy *et al.* (2016)

Trained a supervised classifier

resource heavy	response time
network problem	privacy and ethical issue
feature request	crashing
update issue	uninteresting content
user interface	other
functional complaint	compatibility issue
feature removal	additional cost

| Labeling and Annotation

Noei *et al.* (2019)

Use Standford CoreNLP

Labeling and Annotation

Noei *et al.* (2019)
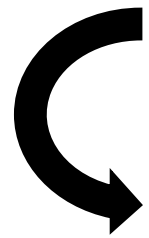
Use Standford CoreNLP

annotates the words in the user-reviews
produces the base forms and the parts of speech
identifies the structure of sentences

Labeling and Annotation

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

Coreference Resolution

Labeling and Annotation

Resolving Synonyms
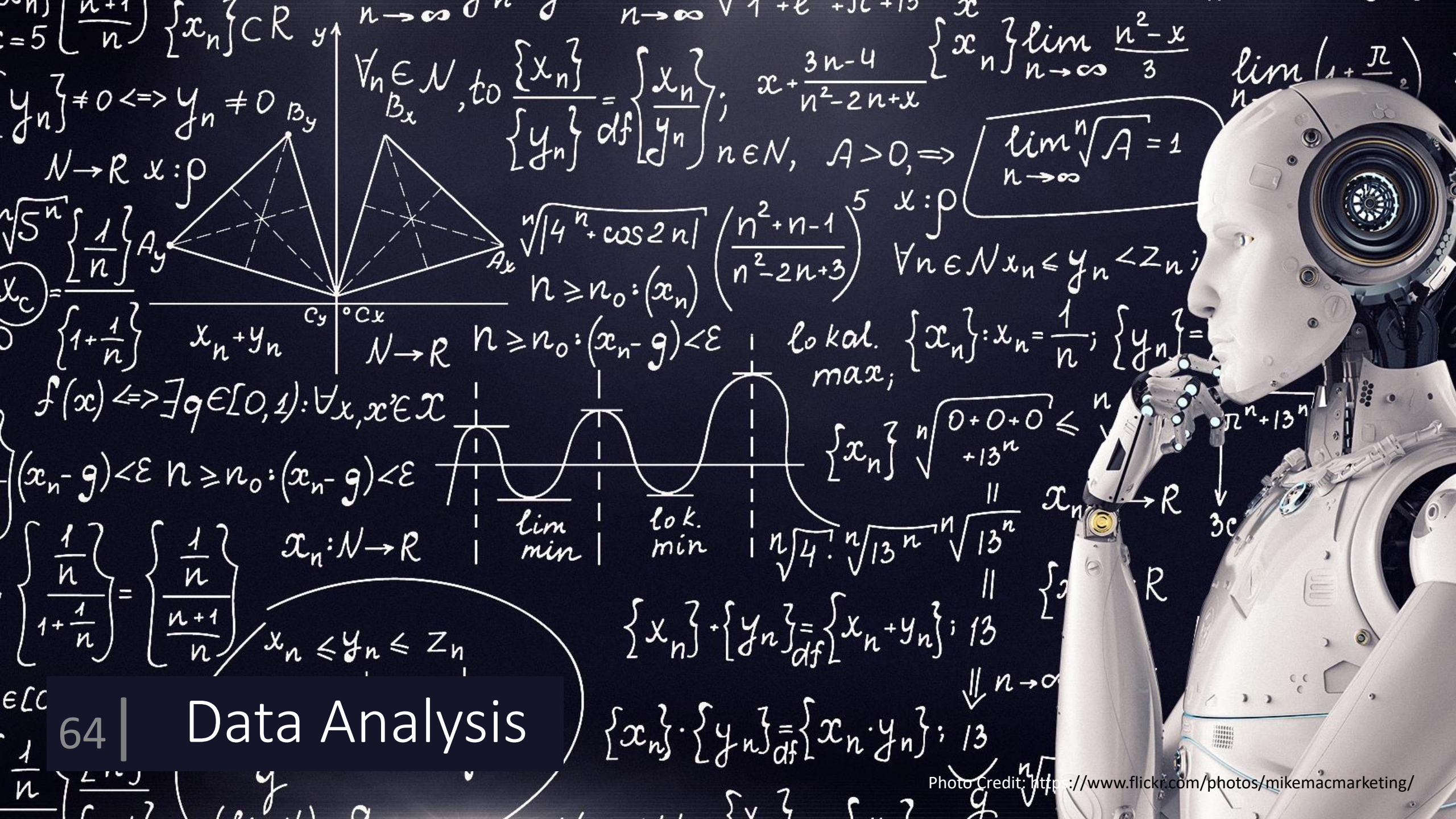
Resolving Negations

Clustering

53 | Resolving Synonyms

Resolving Synonyms
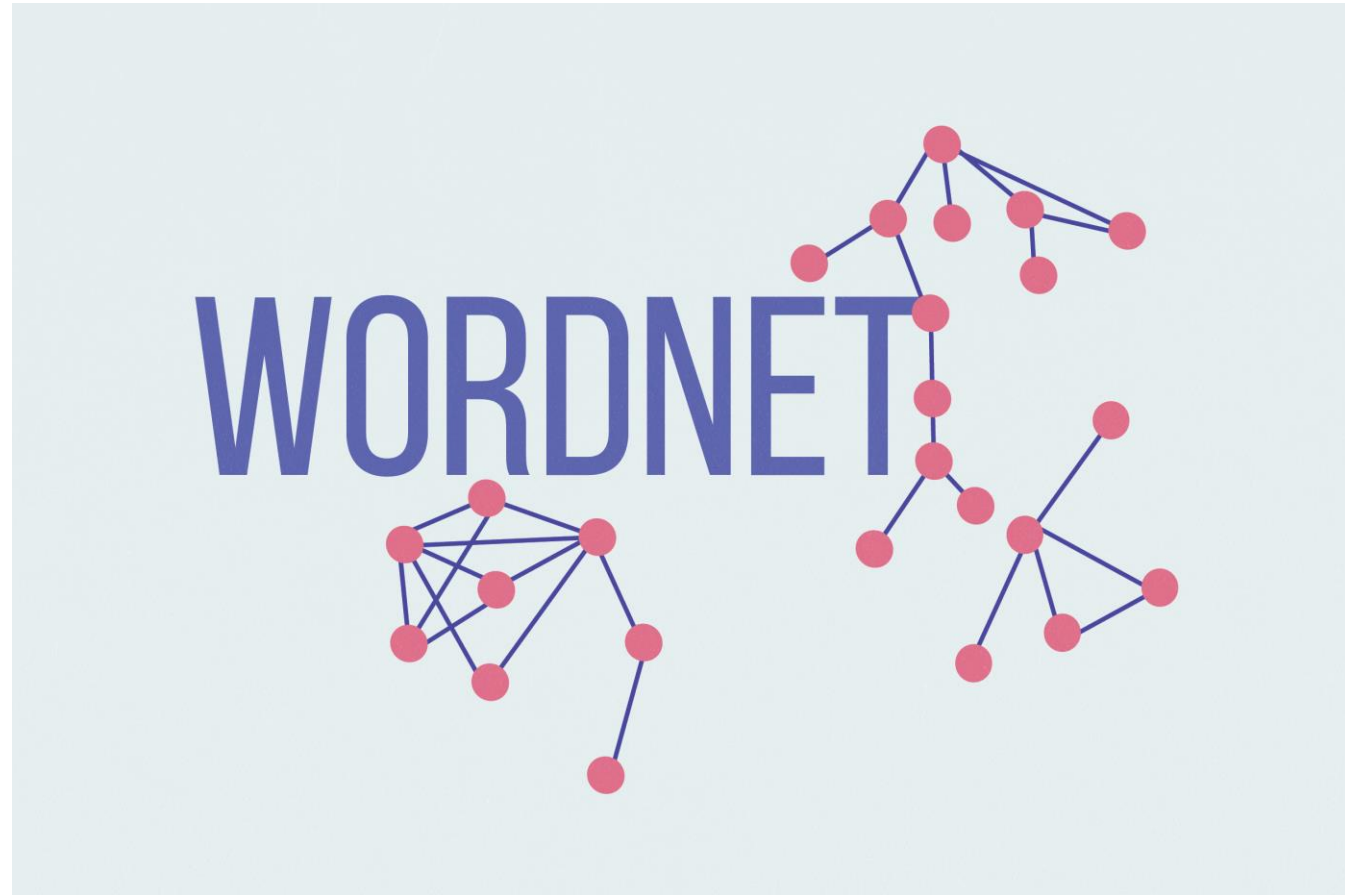
Create their own dictionary of words
    Bavota *et al.* (2015)
    Noei *et al.* (2018)

Resolving Synonyms

Photo Credit: https://pixabay.com/photos/girl-white-fun-kid-literature-3038974/

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

Coreference Resolution

Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

56 | Resolving Negations

[…] THIS FUNCTIONALITY IS NOT GOOD!

57 | Resolving Negations

Identifying Inconsistent User-Reviews

Identifying Uninformative User-Reviews

Correcting Typos

Coreference Resolution

Labeling and Annotation

Resolving Synonyms

Resolving Negations

Clustering

58 | Clustering

Clustering

Clustering

Clustering

Cluste
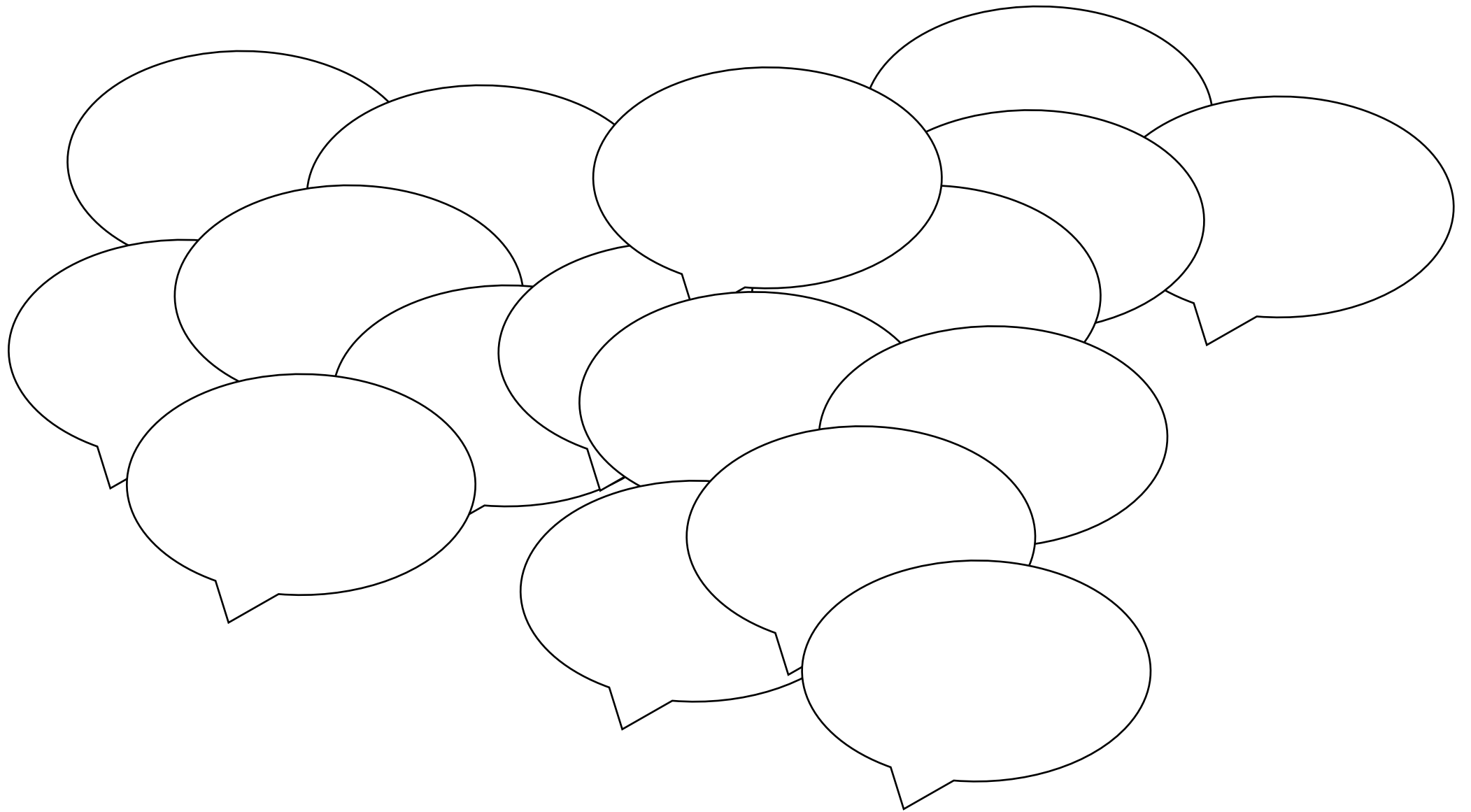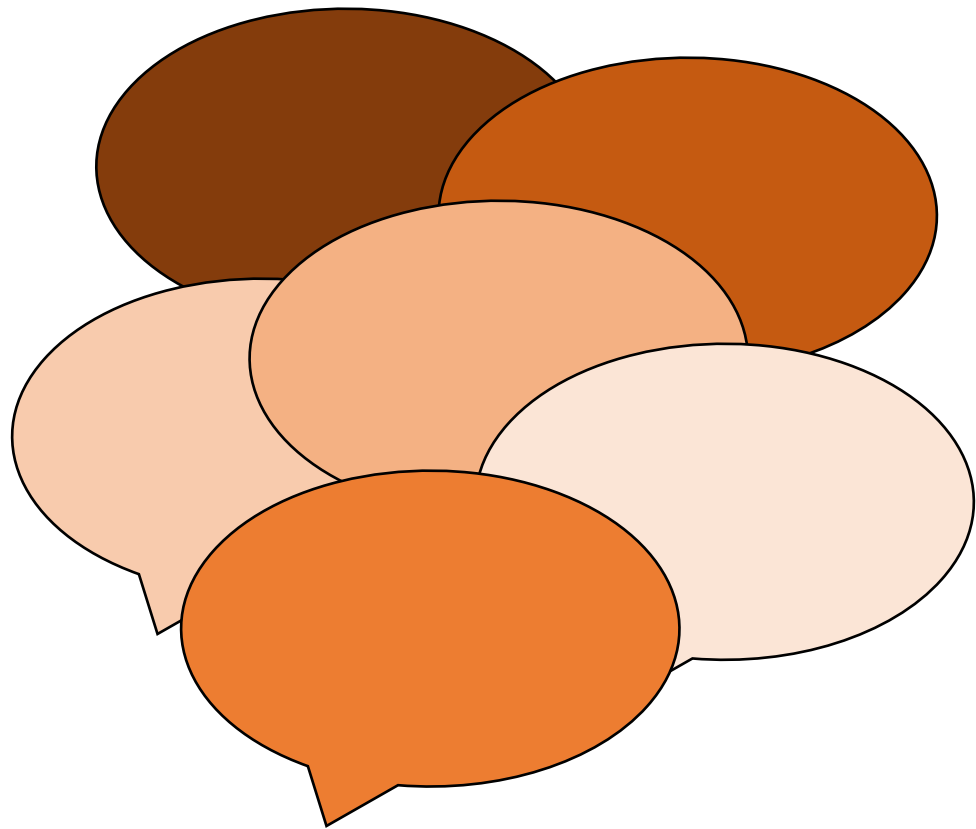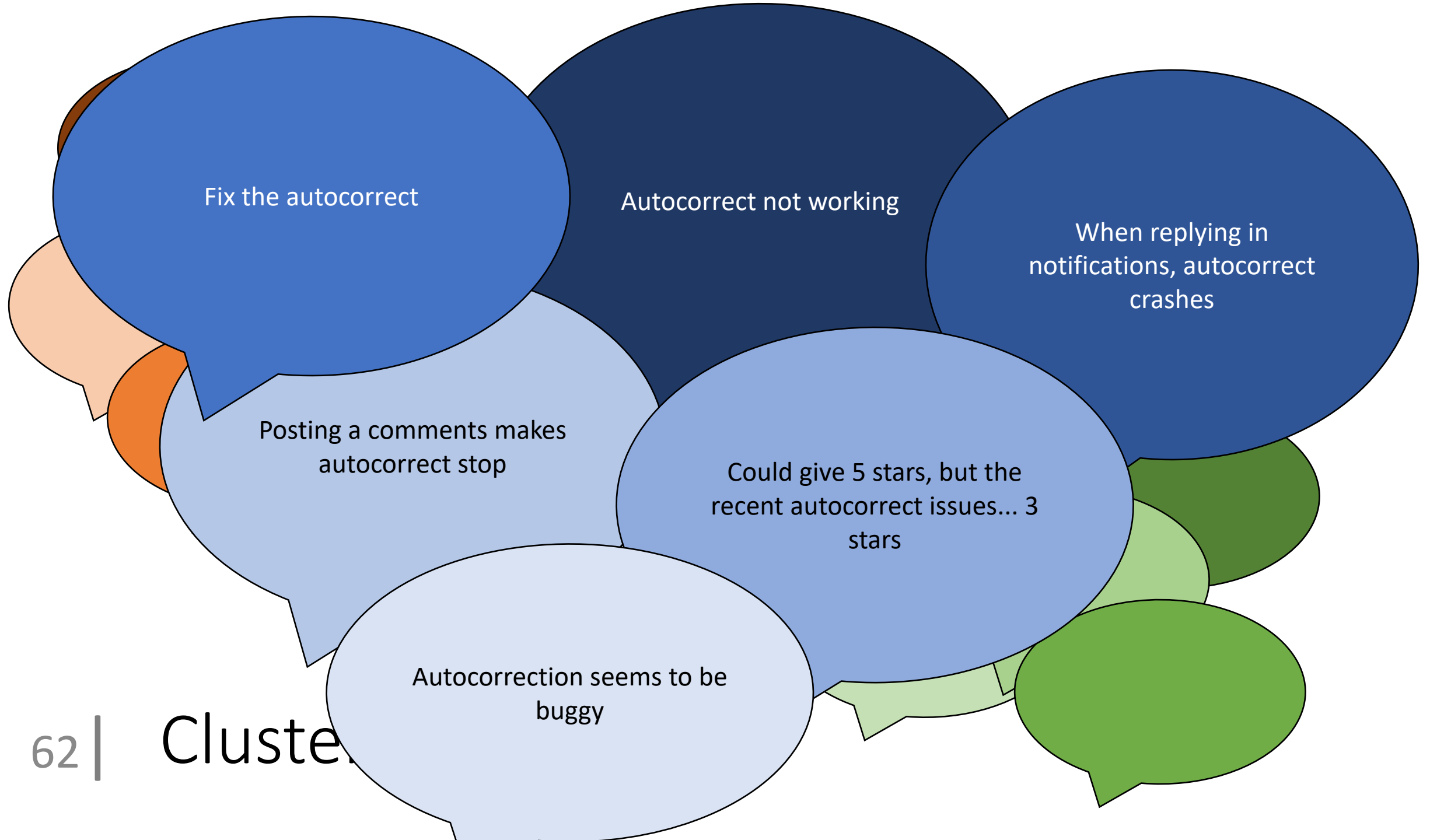
Noei *et al.* (2018) reported a significant 45% increase in the precision of mapping user-reviews (from Google Play Store) to issue report (from GitHub) after grouping similar user-reviews together.

64 | Data Analysis

Photo Credit: https://www.flickr.com/photos/mikemacmarketing/

Goal

Variables

Method

Representative Data

Data Analysis

Martin *et al.* (2015) reported that using an incomplete set of data in Blackberry World App Store biases the final findings.

66| Data Analysis

Importance of user feedback

Information provided by user-reviews

Continuous app development

Data collection

Data preprocessing

Analysis

Conclusion

Importance of user feedback

Information provided by user-reviews

Continuous app development

Data collection

Data preprocessing

Analysis

Ehsan Noei

e.noei@utoronto.ca

http://individual.utoronto.ca/noei

Conclusion