Hashtag Segmentation of Conversational Tweets in Turkish, Modelling Segmentation Approach Final Report

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Twitter is the latest social networking tool which affects everything related to the person. Twitter allows its users to write at most 140 character long update, it is known off as "tweet". In this research, analyzing segmentation of hashtags from tweets is our main objective. There are several researches in English, but not that much in Turkish. Studying with the Turkish corpus is somehow hard to study, because Turkish resources have grammer problems due to the English effect. The usage of the hashtags differ in country to country. Having more than one word in the hashtag or lapsus calami prevent researchers to work properly. It is the first project in Turkey to segment tweet's hashtags in Turkish. Therefore, the results of our project is milestone in that manner. It will assist oncoming projects in the case of corpus and method needs. The other part of the project is analyzing hashtags in the way of linguistics. Analyzed corpus will give more information about related countries. In the other words, short-term hashtag analyses keep informed about spesific situations which influence the society. After all said and done, we will recognize the strength of computer science on natural languages.

Keywords: Twitter; Tweet; Tweets; Hashtag; Segmentation; Turkish; Conversational Tweets; Hashtag Segmentation

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1. INTRODUCTION AND MOTIVATION

1.1. Introduction

1.1.1. The Story of Hashtag

A hashtag is a type of label or metadata letters used especially on social network and microblogging services which makes it easier for users to find messages with a specific theme or content.

The story is began with Twitter but has extended to other social media platforms as well as "facebook". In 2007, developer Chris Messina proposed, in a tweet, that Twitter begin grouping topics using the hash symbol. Twitter initially rejected the idea. But in October 2007, citizen journalists began using the hashtag "#SanDiegoFire", at Messinas suggestion, to tweet updates on a series of forest fires in San Diego.

1.1.2. Decision of Hashtags

Which characters can be defined as #hashtag is the important part of our project.

A hashtag is defined by any string prefixed with a "#", for instance, #freedomtomark, #shesuggest. The string can be a single word, an acronym, or multiple words joined together, and usually identifies the subject topic of the tweet (e.g., #ENG493) or expresses a comment about it (e.g., #kappamevku).

Spaces are an absolute segmentation rule. Even if hashtag contains multiple words, they should be together. Using capital letters in between words have no meaning. (#CahitArf). Uppercase letters will not alter search results, so searching for #CahitArf will yield the same results as #cahitarf.

Numbers are supported in Twiter, so as #23NisanBayrami. However; punctuation marks, commas, periods, exclamation points, question marks and apostrophes are forbidden characters. In addition to them; asterisks, ampersands or any other special characters are also restricted ones. There is no preset list of hashtags. Creating a brand new hashtag is simple by putting the hash before a series of words, and if it hasn't been used before, a new hashtag is invented.

1.1.3. Origin of Implementation

The main objective is to implement machine learning based hashtag segmentation application.

The first work was using twitter developer tools to extract tweets from Tweeter's database. In the case of hashtag extraction, there are several issues. Using large amount of raw data that is recieved from social media is the way of creating corpus. In the field of natural language processing, the essential requirements are datasets. Having realiable training and test data helps to improve current algorithm. Because languages are flexible and few training and test data cause to reproduce wrong idea. It somehow clarifies why there is not enough research in Turkish. That is because, improving datasets might help researchers to test their idea and models in the future.

The starting point of project is primarily based upon gathering sufficient data to avoid backing to drawing point. That is, being blind to quantity of data causes to quit idea. Hence, the researcher should collect large amount of data, but also with well-selected contents. When the research topic comes to natural language processing, size and quantity of data is important. Extending corpus enhances current models to achieve better results.

1.1.4. Word Segmentation

Word segmentation means dividing a text into meaningful words. Human-beings can divide text into words with their mental process, but computer not. Word segmentation became more difficult, meanwhile not using a seperator or using more than one form for seperation. Hence, natural language processing begins after that field.

There are several methods about word segmentation. Methods will be discussed in the case of convenience with Turkish.

1.2. Motivation

The common problem about languages which have Latin alphabet system is deciding the word boundary. There are three types of word boundary type.

First one is using space between words. We can not use space segmentation in our project, because hashtags do not contain spaces. Second type is using uppercase letters at the beginning of words or using underscore between the words. It is the main seperation rule of our word segmentation. If hashtags have more than one word in it, we can check the uppercase letters or underscores to decide word boundaries. However; when it comes to real world, the usage of letters in hashtags differs from the second type. The third one is using no uppercase or using nonsense uppercases in hashtags. Because of the natural languages' aspects, datasets contain the hashtags which are the third type of boundary type.

For natural language processing, we have to determine the word's boundaries first. The method that we used tries to work on collected data to create a model that demonstrates the Turkish words' structures.

2. STATE OF ART

2.1. Related Papers and Projects

There are no paper or research about hashtag segmentation in Turkish. So that, the discussion will be based upon other versions of hashtag segmentation and as well as word segmentation.

The problem of word segmentation has been studied in various contexts. One of the most frequently used method for that is maximum matching, by Wong and Chan 1996. Many approaches help us to handle unknown words and to get best proper answer in the case of ambiguity. Venkataraman[1] uses unsupervised word segmentation techniques for finding words in automatically transcribed speech. Recently, Macherey et al.[2] use unsupervised techniques for word segmentation, highlighting the application of this technique to multiple European languages. The work of Wang et al.[3] use unsupervised techniques with multiple corpora for word segmentation.

2.1.1. Exploring the Use of Hashtag Segmentation and Text Quality Ranking

A common practice in tweets is to identify their subject topic by means of a hashtag. In this project, they have given information that a hashtag cannot contain white spaces. They also noticed that people usually concatenate

[1] A. Venkataraman. A statistical model for word discovery in transcribed speech. Computational Linguistics, 2001.

[2] K. Macherey, A. M. Dai, D. Talbot, A. C. Popat, and F. Och. Language-independent compound splitting with morphological operations. In ACL HLT, 2011.

[3] K. Wang, C. Thrasher, and B.-J. P. Hsu. Web scale nlp: a case study on url word breaking. In Proceedings of the 20th international conference on World wide web, New York, NY, USA, 2011. ACM.

more words together, to form a short phrase. They also mentioned that the distinct words composing a hashtag is not a simple task to be automatized.

It is obvious that our project and their project are based on the same aspects like; "Some users identify the distinct words using a CamelCase style, i.e., capitalizing the first letter of each word, other leave the words all in lowercase or uppercase. Other use underscores _ to separate words, but it is not a common case because is wastes characters. Usually words are just juxtaposed without any evident or coherent use of separation signs and actually there are no common rules one can rely on to segment hashtags."[4] They demote their problem as word segmentation problem. The next figure represents the working principles of their system. That system uses the same learning data path as we have.

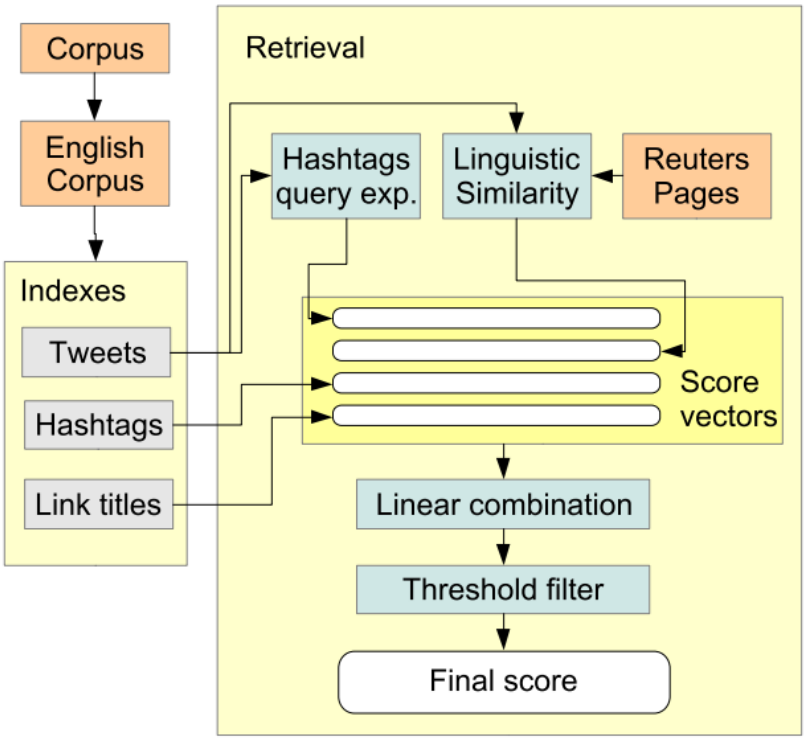


FIGURE 1. Modules of System

They used the words distribution model and a hashtag, the hashtag segmentation module converts the hashtag to a vector of words composing them. Finally, the last figure related to that paper is about how big dataset's size is.

2.1.2. Segmenting Web-Domains and Hashtags using Length Specific Models

In this project, they study two applications in the internet domain. First application is the web domain segmentation which is crucial for monetization of broken URLs. Secondly, they propose and study a novel application of twitter hashtag segmentation for increasing recall on twitter searches. They remark that existing methods for word segmentation use unsupervised language models.

They have realized that when using multiple corpora, the joint probability model from multiple corpora performs significantly better than the individual corpora during the project. Motivated by this, they propose weighted

[4]ISTI@TREC Microblog track 2011: exploring the use of hashtag segmentation and text quality ranking, Giacomo Berardi, et al.

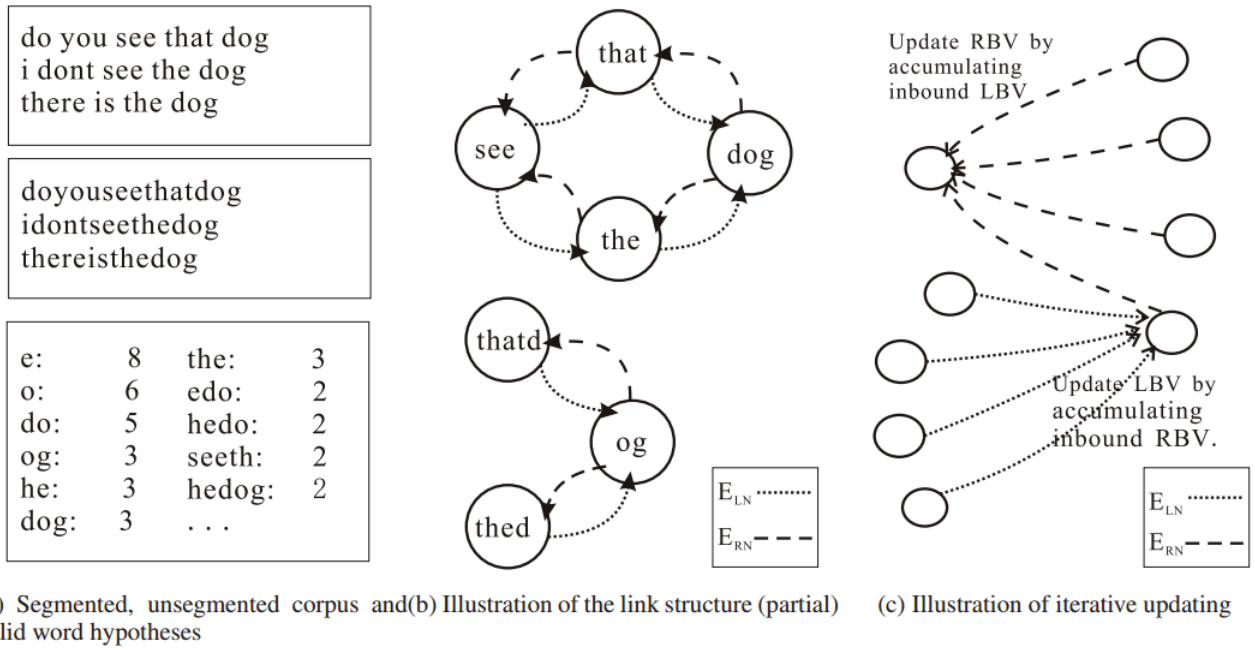
	total	effective	retweets	null	hashtags	users
Entire corpus	16.141.812	13.812.346	1.104.780	1.224.686	655.850	5.356.842
English set	4.510.329	4.068.158	442.171		288.753	2.021.759
Hashtags subset	791.464	640.870	150.594		288.753	514.401
Link subset	676.957	674.471	2.486		14.399	400.631

FIGURE 2. Some statistics from the corpus and the subsets that is selected for indexing, the total number of tweets is divided in effective tweets, retweets and null tweets. The hashtags column indicates the number of unique hashtags.

joint probability model, with weights specific to each corpus. Finally, they observed that length of segments is an important parameter for word segmentation. The length specific models further improve segmentation accuracy over supervised probability models.

2.1.3. A Simple and Effective Unsupervised Word Segmentation Approach

In this paper, they propose a new unsupervised algorithm to achieve word segmentation. The main idea of their approach is a novel word induction criterion which is similar with second paper. As they explain; "We devise a method to derive exterior word boundary information from the link structures of adjacent word hypotheses and incorporate interior word boundary information to complete the model."[5] They have also worked with Chinese datasets to claim their approach. If it is working with even difficult language systems, it will be achieved with other systems. They also reported that their approach is simpler and more efficient than the Bayesian methods and more suitable for real-world applications.



(a) Segmented, unsegmented corpus and valid word hypotheses (b) Illustration of the link structure (partial) (c) Illustration of iterative updating

FIGURE 3. Illustrations of constructing the link structures of word hypotheses and calculating the exterior boundary values.

[5] A Simple and Effective Unsupervised Word Segmentation Approach, Songjian Chen, Yabo Xu, Huiyou Chang

2.1.4. URL Segmentation

Another approach is word segmentation of URL links. To think about the word segmentation and recognition problem for URL links, reasearchers adopt some basic principles from rulebased approach.

The dictionary should have sufficient amount of word entries. However, the occurence of compound words makes it very difficult to match every component string exactly with the dictionary entries. Evaluation of the hashtag segmentation has started to be improved with search engine improvements of Twitter.

Finite state transducer is an approach for title token base URL segmentation. It splits and segments according to previous-seen web page title simultaneously. For example, URL link includes "cs" that might correspond to "computer science" in many training page's title. If "cs" is encountered in the testing corpus, it is automatically expanded to "computer science". The tranducer has several rules that give score. This score can be obtain by certain moves which match or skip letters in the tokens of title with corresponding letters. Expansion can be valid if it covers all letters in the segment.

2.2. Improvement of Our Project

In our project, there are several improvements according to local and global researches.

3. METHODS

We have tried to discourse manly with 3 methods. Hashtag segmentation can be generally defined as word boundry detection. Because of this, we start with detection of the word boundry. There are two featurebased learning methods, Conditional Random Fields (CRFs)(Laerty et al.,2001) and Maximum Entropy (MaxEnt). CRFs can represent the uncommon parts of the information as elements furthermore, are great at displaying grouping marking problems. MaxEnt is extremely compelling at learning with a high assortment of components, without agonizing over the multifaceted nature of the model. Hidden Markov Model is a simplistic approach for word segmentation. It helps us to built character trigrams. It tries to catch boundary characters that are current and previous ones. Peter Norvig's implementation can be used for word bigrams.

Manual annotation is time consuming task and it limits the amount of trainig data that can be created. We try to achieve utilizing data to create training sets for hashtag segmentation. Synthetic hashtags by concatenating the words in tweets can also be used for training data because word boundries are known. To use concatenating the words in tweets as training dataset, we need to filter nonword tokens. If tweets include nonword token in the beginnig or end of the text, it can be removed and other words can be used as trainig data. On the other side, if a nonword token appear in the middle of the text, the tweet is dicarded because nonword token ib the middle of the tweet may distort the word order. The word order is important point of trainig data.

Word boundry detectiton and word segmentation is very important for Chinese words segmentation. A good research about Chinese word segmentation can be found out in Wu and Tseng's paper. A Chinese senteces do not include delimiters to seperate words. It includes combined of a string of characters. Netural networks and lazy learning (just-in-time learning) approaches are methods that are used in word segmentation. Processing of the examples are collected until a clear request for information is received. When the information recieved, the databse search is completed according to amount of the distance that is most related to query.

We can use each character of training data to represent one function of learning system. Some features should be determined and each character should be examined according to these features to create machine learning system.

4. RESULTS

We have collected the tweets from twitter. We tokenize tweets, normalize them and get hashtags from them. We have stored all information related to tweets. That will help us to recognize training and test data. The training data will be the part of the current data.

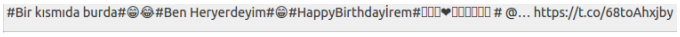
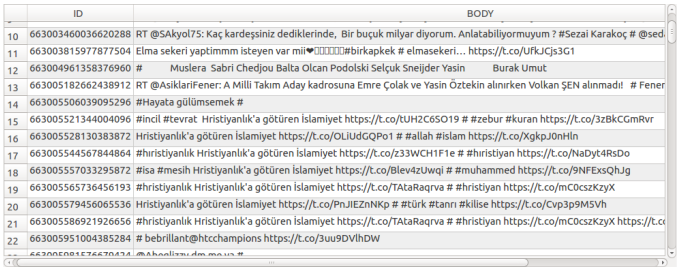


FIGURE 4. Tweet example.

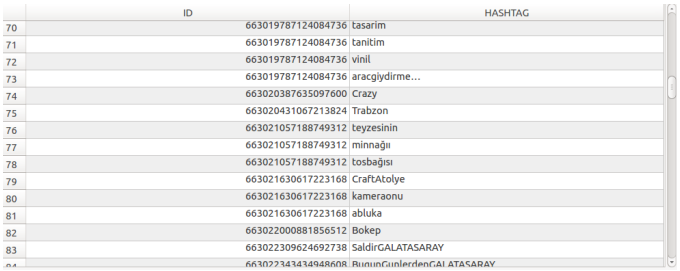
Implementing a method to get hashtags and insert them database is accomplished. There are two kind of table as well as "TEXTS" which contains unique tweet IDs and tweet text.



	ID	BODY
10	663003460036620288	RT @SAkyol75: Kaç kardeşsiniz dediklerinde, Bir buçuk milyar diyorum. Anlatabiliyormuyum ? #Sezai Karakoç # @sed
11	663003815977877504	Elma sekeri yaptimmm isteyen var mii❤□□□□□#birkapkek # elmasekeri... https://t.co/UfkJCjs3G1
12	663004961358376960	# Muslera Sabri Chedjou Balta Olcan Podolski Selçuk Sneijder Yasin Burak Umut
13	663005182662438912	RT @AsiklariFener: A Milli Takım Aday kadrosuna Emre Çolak ve Yasin Öztekin alınırken Volkan ŞEN alınmadı! # Fener
14	663005506039095296	#Hayata gülümsemek #
15	663005521344004096	#incil #tevrat Hristiyanlık'a götüren İslamiyet https://t.co/tUH2C6SO19 # #zebur #kuran https://t.co/3zBkCGmRvr
16	663005528130383872	Hristiyanlık'a götüren İslamiyet https://t.co/OLiUdGQPo1 # #allah #islam https://t.co/XgkpJ0nHln
17	663005544567844864	#hristiyanlık Hristiyanlık'a götüren İslamiyet https://t.co/z33WCH1F1e # #hristiyan https://t.co/NaDyt4RsDo
18	663005557033295872	#isa #mesih Hristiyanlık'a götüren İslamiyet https://t.co/Blev4zUwqi # #muhammed https://t.co/9NFExsQhJg
19	663005565736456193	#hristiyanlık Hristiyanlık'a götüren İslamiyet https://t.co/TAtaRaqrva # #hristiyan https://t.co/mC0cszKzyX
20	663005579456065536	Hristiyanlık'a götüren İslamiyet https://t.co/PnJIEZnNKp # #türk #tanrı #kilise https://t.co/Cvp3p9M5Vh
21	663005586921926656	#hristiyanlık Hristiyanlık'a götüren İslamiyet https://t.co/TAtaRaqrva # #hristiyan https://t.co/mC0cszKzyX https://t.c
22	663005951004385284	# bebrillant@htcchampions https://t.co/3uu9DVlhDW

FIGURE 5. Text database table representation.

The other one is "HASHTAGS" which contains tweet IDs and hashtags. Segmentation algorithm is almost done.



	ID	HASHTAG
70	663019787124084736	tasarim
71	663019787124084736	tanitim
72	663019787124084736	vinil
73	663019787124084736	aracgiydirme...
74	663020387635097600	Crazy
75	663020431067213824	Trabzon
76	663021057188749312	teyzesinin
77	663021057188749312	minnağı
78	663021057188749312	tosbağısı
79	663021630617223168	CraftAtolye
80	663021630617223168	kameraonu
81	663021630617223168	abluka
82	663022000881856512	Bokep
83	663022309624692738	SaldirGALATASARAY
	663022343434948608	BugunGunlerdenGALATASARAY

FIGURE 6. Hashtag database table representation.

5. CONCLUSION

We proposed a simple and effective unsupervised word segmentation approach. The criterion incorporates boundary information to model words.

6. FUTURE WORK

We decided to improve our segmentation algorithm. Features of the words will be dicussed. Training and test datasets will be prepared. Every word in the training data will be used to improve machine learning power of our project. Later future works will be consulted to Prof. OZGUR.

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8. APPENDIX