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DESCRIBING DOGGO-SPEAK:
FEATURES OF DOGGO MEME LANGUAGE

by

JENNIFER BIVENS

A master's thesis submitted to the Graduate Faculty in Liberal Studies in partial fulfillment of
the requirements for the degree of Master of Arts, The City University of New York

2018

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This manuscript has been read and accepted for the Graduate Faculty in Liberal Studies in satisfaction of the thesis requirement for the degree of Master of Arts.

Date

William Sakas

Thesis Advisor

Date

Gita Martohardjono

Executive Officer

THE CITY UNIVERSITY OF NEW YORK

ABSTRACT

Describing Doggo-Speak: Features of Doggo Meme Language

by

Jennifer Bivens

Advisor: William Sakas

Doggo-speak is a specialized way of writing most commonly associated with captions on Doggo memes, humorous images of dogs shared in online communities. This paper will explore linguistic features of Doggo-speak through analysis of social media posts by Doggo fan pages. It will use the discussed features as inputs to five machine learning classifiers and will show, through this classification task, that the discussed features are sufficient for distinguishing between Doggo-speak and more general English text.

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1. INTRODUCTION

Humor is often spread among internet users in the form of memes. One such meme is Doggo. The word *Doggo* for these memes is a reference to their content, dogs. In their most common form, Doggo memes consist of images of dogs and captions.

1.1 History of Doggo

As early as 2010, a closely related predecessor of Doggo memes, Doge, was beginning to spread in online communities. Over the next few years, Doge memes featuring Shiba Inu dogs gained popularity on sites like Reddit (Chayka). Even YouTube acknowledged the trend by changing the site's font style and color when users searched for Doge memes (Hopewell). In 2014, a trading card accessory company attempted to acquire a trademark for the word *Doge* to be used in merchandise with the image of Kabosu, the Shiba Inu featured in what is considered to be the first Doge meme (Gillespie). Kabosu was also used in the marketing of a Bitcoin alternative (Chayka).

Doge's popularity was followed by that of Doggo, a meme with a similarly dog-related name. Many hypotheses exist to explain why the word *doggo* was created and used for these memes. Some point to roots in the early 1800s or connections to the suffix -o, meaning "one that is, has the qualities of, or is associated with" ("Words We're Watching").

Many distinct memes exist in the Doggo group. One such meme is Bamboozle. In a Bamboozle meme, a dog in a costume speaks directly to readers. The dog reveals that it is wearing a costume and implies that the reader did not realize the dog was, in fact, a dog. The text says that the reader has been "bamboozled" by the tricky dog ("Bamboozle").

Another popular Doggo meme is Doggo Fight. Doggo Fight memes set up future fake battles between two pictured dogs. Each of the dogs is assigned humorous special attacks related to its appearance or costuming in the image. Users vote for the dog they believe would win the fight using its special attacks ("Doggo").

Perhaps the most widely recognized Doggo memes are those created by the We Rate Dogs Twitter page. The page was started in 2015 by a Campbell University student, Matt Nelson. On the page, users submit pictures of dogs they encounter in their real lives and the dogs are rated out of 10 points. The ratios often exceed 1, such as the rating 12/10 (Macdonald).

Nelson has been credited with much of the popularization of Doggo memes. He points to humor from Weird Twitter, a subculture of Twitter dedicated to surrealist humor, as part of his inspiration in creating the page (Greenwell). This connection between Doggo and Weird Twitter is mentioned in the Oxford Dictionaries blog as well. Graham notes that Doggo memes contain a “palatable” version of Weird Twitter-style humor, while pointing out that the very definition of Weird Twitter is itself nebulous.

In addition to appearing in memes online, Doggo is referenced in other forms of entertainment. For example, the video game Undertale features characters like Doggo, Dogi, and Greater Dog (Hall).

1.2 Doggo-Speak

The captions in Doggo memes are written in Doggo-speak, also referred to as Doggo-Lingo or DoggoSpeak, which is a “specialized vernacular used primarily in memes extolling the cuteness of dogs” (Valdez). These captions often contain intentional misspellings, omissions,

transformations, and other modifications of English that contribute to the humor of the memes. Though Doggo-speak is usually paired with a Doggo meme image, it can also stand alone, as evidenced by the thousands of text-only contributors and commenters on Doggo social media pages.

Despite the attention Doggo-speak has received in popular culture, it has been relatively unmentioned in linguistic publications.

Published analyses of Doggo-speak in popular media often focus on onomatopoeic vocabulary additions as a primary feature (Boddy; Graham). In the Oxford Dictionaries blog, Graham points out that Doggo-speak shares similarities with other internet subculture languages, both in its structure and in specific vocabulary choices. In "Dogs Are Doggos: An Internet Language Built Around Love for the Puppies," Jessica Boddy says that Doggo-speak is a "hodgepodge of existing Internet language" and emphasizes its "cutesy" nature.

The rating format used in the We Rate Dogs memes is also "a familiar formula online" according to Graham. Some phrasing in Doggo-speak contains reformulations of LOLCat and Doge humor. Graham provides a reason for the frequency of misspellings in Doggo-speak as a "knowing spin on internet textuality at large," a joke built on a history of the internet containing misspellings due to user and automation errors. Graham also points out the unusual verb conjugation patterns in Doggo-speak but does not analyze this feature in detail.

Some linguists assert that Doggo-speak is distinct from other meme languages in that humans are the speakers instead of the animals featured in the memes (Boddy). However, many instances of Doggo-speak appear to originate from the subjects of the memes. Bamboozle memes are an example of this, in which the text often follows a predictable formula, resulting in captions like

"Am actually doggo, not [costume]. Heckin' bamboozled!" Some texts refer to a "hooman" (Floof Bork Snoot 'N' Boop Ltd., "SHOOOOB"), which suggests that the speakers themselves are not human.

1.3 Project Goal

The goal of this project is to produce a set of linguistic features that describe Doggo-speak. These features will be validated as representative of Doggo-speak using five classifiers in multiple machine learning paradigms.

An underlying assumption of this project is that it cannot be inclusive of all the variations of Doggo-speak, as Doggo-speak is generated by many users and has no prescriptive grammar. Therefore, this analysis attempts to capture the most prominent and shared features of Doggo-speak, regardless of author or context. When significant variations in the discussed features vary by user, those differences are noted.

Further, the non-Doggo-speak dataset used in the classification task is not representative of all types of English and does not contain other examples of meme-speak. Therefore, this project is not intended to identify Doggo-speak as compared to other meme languages. Instead, it will focus on the differences between Doggo-speak and more general English.

Analyses will be presented for five feature groups of Doggo-speak that were selected to be, in combination, representative of Doggo-speak. These feature groups are as follows.

1. Do Rule
2. Usage of *Heck*
3. Pronoun Mismatch Rules
4. Spelling Transformations
5. Capitalization Rules

Features relying solely on specialized and dog-related vocabulary in Doggo-speak, such as the presence of terms like *bork*, *doggo*, and *mleerm* are intentionally omitted. These vocabulary additions, while obvious parts of Doggo-speak, are context-dependent. It is the goal of this paper to describe Doggo-speak with a set of features that are not dependent on the subject matter of the text.

These features will be used as inputs to five machine learning algorithms, which will be trained to classify input text as either *Doggo-speak* or *Not Doggo-speak*. This project will show that these minimal features of Doggo-speak, given as inputs to a machine learning algorithm, are sufficient for the successful classification of Doggo-speak as compared to more general English text.

1.4 Doggo-Speak Data

The analysis presented in this paper will focus only on meme captions created by Doggo Facebook fan pages. The captions considered are not embedded in the images themselves; only captions appended to images are included. The purpose of this restriction is to ensure that the text studied reflects the most common form of Doggo-speak, as written by popular users in the

online communities familiar with Doggo memes.

Over 200 instances of Doggo-speak were collected from three Doggo fan pages. Posts from November 2017 through April 2018 were studied. Posts by the fan pages that were not primarily written in Doggo-speak (often, posts promoting merchandise sales) were not included.

2. DO RULE

One of the most noticeable features of Doggo-speak is the Do Rule. The Do Rule is a non-standard verb conjugation characterized by four transformations. The presence of an indirect object, while common, is not required.

When no direct object is present, all four transformations still occur. In both cases, the first two rules are interchangeable in order. The last two rules are also interchangeable. The four transformations of the Do Rule are listed below.

1. Change the head of the verb phrase to its base form
2. Move the head of the verb phrase to the nominal direct object position
3. Insert *a* in the determiner position of the direct object
4. Insert *do* in the now-empty head of the verb phrase

This results in a basic sentence ordering of [*do*, INDIRECT OBJ, *a*, GERUND], as in the fictional examples below. Without an indirect object in the sentence, the ordering would be [*do*, *a*, GERUND].

- He is [doing me a frighten].
- She will [do a like].
- They [did me a concern].

Below, the transformations of the Do Rule are applied to an example sentence, "**He is frightening me.**"

1. The first transformation changes *frightening* to its base form, *frighten*.

He is frighten me.

2. The second transformation moves *frighten* to the direct object position. This transformation requires that the verb become a gerund, as it is moving from a verb position to a noun position. This also changes *me* from being a direct object to an indirect object. When the direct object contains modifiers, such as the second person possessive pronoun *your*, the modifiers remain attached to the head of the phrase when the verb is moved (Bork Bork I Am Doggo, "Only 5 days left").

He is me frighten.

3. The next transformation fills the empty determiner position that was created in the movement of *frighten* with the determiner *a*.

He is me a frighten.

4. The final transformation adds the iconic *do* to the empty verb head left by *frighten*.

He is doing me a frighten.

In instances of the Do Rule, *do* is correct in person and number. Verb tense for *do* is the same as the verb whose position it occupies. While present tense is by far the most common for verbs, other tenses are attested. This difference in frequency may be due to the nature of Doggo memes, which often describe current actions or thoughts.

There appears to be no contextual restriction on the application of the Do Rule. The thematic roles of agent and theme are able to be filled by humans, animals, and inanimate objects.

Interpreting one of the most common Do Rule phrases in Doggo-speak requires special consideration. This phrase is "do a happy." Many author-specific variations of *happy* are attested, including *happ* and *happi*. Because we assume that the pattern of a sentence that has undergone the Do Rule and has no indirect object is [*do, a, GERUND*], *happy* appears to be a gerund. This means that, in the pre-transformation sentence, *happy* would have been a verb.

Assuming that the verb form of *happy* follows the same pattern as the words *frightening* or *concerning*, in which the verb contains the present participle suffix *-ing* in pre-transformation sentences, the verbal form of *happy* may be *happying*. Applying the Do Rule to the sentence "He is happying" would result in "He is doing a happy," as shown below.

He is happying.

1. Verb to base form: **He is happy.**
2. Move verb to direct object: **He is happy.**
3. Add determiner *a*: **He is a happy.**
4. Add *do*: **He is doing a happy.**

This pattern of verb creation in Doggo-speak is not limited to *happy*, as *Christmasing* appears to be in the pre-transformation sentence for "Doin' a heckin Christmas" (Bork Bork I Am Doggo, "Doin' a heckin' Christmas"). In the case of *Christmasing*, the created verb could be understood as a denominal verb, as it is derived from the noun *Christmas*.

2.1 Exceptions and Restrictions

Rarely, the indirect object follows the gerund, as in “did a take over he bed” (Floof Bork Snoot 'N' Boop Ltd., "Uh oh"). This could either be seen as 1) a variation of the Do Rule in which *take over* is moved to the direct object position and combines with *he bed* to become a single constituent, *take over he bed*, 2) a variation of the Do Rule in which *he bed* was moved from a middle-stage sentence *did he bed a take over* to follow *take over* in the final sentence, or 3) a sentence in which the Do Rule has not been applied.

Some sentences with multiple verb phrases may contain a mixture of Do Rule application and of standard verb conjugation, while other sentences show consistent use of the Do Rule throughout. This inconsistency in the application of the Do Rule, even among the same author, provides evidence that its use is optional.

The only real restriction that appears to exist for the Do Rule is that it cannot occur when the verb head is already *do*, as in “oh GOSH what have you DONE chef shoob!>!?!?” (Floof Bork Snoot 'N' Boop Ltd., "oh GOSH"). The hypothetical *do a do* does not appear to be valid.

2.2 Feature Description

- Feature 1 - Do Rule: A sentence will be marked *true* for the Do Rule if it contains the sequence [*do*, (NOUN), *a*, ADJ₀, GERUND]. The gerund at the end of the sequence is valid regardless of how it is tagged with a part-of-speech tagger, provided it is able to function as a verb when free of the context of the surrounding sentence.

3. USAGE OF *HECK*

Heck is a versatile word in Doggo-speak, filling multiple parts of speech. True to the generally optimistic and innocent tone of Doggo-speak, *heck* is often used in place of negative words.

Heck can replace expletives in any part of speech. A person can be a "hecker" (Floof Bork Snoot 'N' Boop Ltd., "Bamboozled again") and someone can not "have time for your heck" (Floof Bork Snoot 'N' Boop Ltd., "Doggo just doesn't"). *Heck* can also participate in expletive infixation to create words like *heckfaced* in "Happ New Yeer!! Be safe, get heckfaced responsibly!" (Bork Bork I Am Doggo, "Happ New Yeer").

Heck may also optionally be censored, underlining the intent of writers to use it as an expletive. The example below shows the use of an asterisk replacing the *e* in *hecking* as an example of censoring.

- "SHOOOOB wants the Yum juice. Hooman
just h*cking p r o v i d e" (Floof Bork Snoot 'N' Boop Ltd., "SHOOOOB")

Heck also appears in idiomatic expressions. For example, it can be a replacement for *hell* in the idiom *go to hell*. It is also seen in the sequence [ADJ, *as hell*], creating phrases like *cute as heck*. Another example of *heck* in an idiom is in the noun *tearjerker*, which is split apart into *tear* and *jerk* and undergoes the Do Rule. This results in "do a tear a hecking jerk" (Bork Bork I Am Doggo, "Special Fan").

3.1 Interjection

Heck can be used as an interjection, generally describing a humorously negative shock or

emotion. As with many interjections in English, *heck* can be set off by punctuation, such as commas, or combined with words like *aw* and *oh*, as in the examples below. Additionally, *heck* can be used as a stand-alone interjection.

- "Pupper is ready for 2018... oh heck" (Floof Bork Snoot 'N' Boop Ltd., "Pupper is ready")
- "Aw heck German boii, doin catto quite a spook" (Floof Bork Snoot 'N' Boop Ltd., "Aw heck")

3.2 Verb

Rarely, *heck* may take the place of a verb. *Heck* as a verb is usually also an expletive, as in "Heck ur lyf" (Floof Bork Snoot 'N' Boop Ltd., "Heck ur lyf").

3.3 Adjective

Though *heck* can fill many different roles in Doggo-speak, the most common is that of an adjective. As an adjective, *heck* is written as *hecking*, often *heckin*, *heckin'*, or similar, depending on the author. For the data considered, instances of *heckin* without an apostrophe are from a single fan page, while instances with an apostrophe are from a second author. This suggests a lack of a prescriptive spelling rule for *heck* as an adjective, despite its prevalence in that role.

Heck is frequently used in sentences subject to the Do Rule. In these cases, *heck* is used as an adjective to modify the gerund, creating the ordering [*do*, (NOUN), *a*, ADJ₀, HECK_{ADJ}, ADJ₀, GERUND]. In this ordering, the word *do* must be followed by an optional noun, then the word *a*, zero or more adjectives, an adjective form of *heck*, zero or more adjectives, and a verb. The following examples contain this pattern.

- "Floofaid! Ams the World! We're doing a super heckin' excite about this, frens!! Good luck!" (Bork Bork I Am Doggo, "Floofaid")
- "Floof does a heckin' tuck" (Bork Bork I Am Doggo, "Floof does")

3.4 Feature Description

- Feature 2 - Heck: A piece of text will be marked *true* if it contains *heck* or a word beginning with *heck*.

4. PRONOUN MISMATCH RULES

Pronoun Mismatch rules involve inconsistency between pronouns and verbs in the text. A single instance of Doggo-speak may contain any combination of the Pronoun Mismatch rules. These rules are not uniformly applied across Doggo-speak, allowing for a sentence to have a combination of standard English pronouns and those subject to the Pronoun Mismatch rules.

Dogs in Doggo memes are most often referred to with male pronouns. As a result, inconsistencies in pronouns and verbs occur most often for male pronouns.

4.1 Subject/Object Mismatch

Objective pronouns can be used as the subject of a verb, as in “him didn;t get” in the example below.

- "#FREECLOUD

Shoobmster has been bamboozled enough this week, him didn;t get treats when he wanted and you didn't let him sniff all the butts him wanted to." (Floof Bork Snoot 'N' Boop Ltd., "#FREECLOUD")

This example also shows that the Subject/Object Mismatch is not mandatory. The phrase "you didn't let him" uses the correct objective pronoun *him*. This example shows that it is not the case that a single pronoun type, subjective or objective, is chosen and consistently applied throughout the sentence, as the text contains both *he* and *him*. This is best seen in "him didn't get treats when he wanted," which has both subjective and objective pronouns.

4.2 Hims as Him

The most common use of *hims* is as an alternate spelling of the third person masculine objective pronoun *him*. For example, “Flowo make hims happ” (Floof Bork Snoot 'N' Boop Ltd., "Flowo") results from *hims* replacing *him* in *Flowo make him happ*.

When both rules are applied, this rule must follow the Subject/Object Mismatch rule. Using the phrase “Hims fart or no,” (Floof Bork Snoot 'N' Boop Ltd., "What do yuo think"), both possible orderings are listed below. The assumed underlying sentence is "**He fart or no**," meaning "did he fart?"

Option 1: Hims as Him following Subject/Object Mismatch

1. Subject/Object Mismatch: **Him fart or no**
2. Hims as Him: **Hims fart or no**

Option 2: Hims as Him preceding Subject/Object Mismatch

1. Hims as Him: n/a
2. Subject/Object Mismatch: **Him fart or no**

Applying the Hims as Him rule first and then the Subject/Object Mismatch rule would result in "him fart or no," which does not match the target output . However, applying the Subject/Object Mismatch rule first would result in the target "hims fart or no," suggesting that the Hims as Him rule must follow the Subject/Object Mismatch rule.

4.3 Hims as a Possessive

A less common meaning of *hims* is "his." In this case, *hims* is presumably *him's* with an elided apostrophe. In the example below, *hims* is a possessive pronoun in the phrase "hims emotions."

- "Hmm pupper is being pretty ambiguous with hims emotions, is him doin an enjoy? not really sure tbh" (Floof Bork Snoot 'N' Boop Ltd., "Hmm pupper")

4.4 Number Mismatch Rule

The Number Mismatch rule involves inconsistency in number for pronouns and verbs in a sentence. In many examples of Doggo-speak, the pronoun has the correct singular person and number for the context of the sentence. Often, this rule transforms a singular verb into a plural. For example, the phrase *he wishes* has been changed to *he wish* in "Oh mai hevans, he wish" (Floof Bork Snoot 'N' Boop Ltd., "Oh mai").

The examples below have additional instances of the Number Mismatch rule.

- "Clip clop neigh doggo meet pupper, he shlurp" (Floof Bork Snoot 'N' Boop Ltd., "Clip clop")
- "he awooo" (Floof Bork Snoot 'N' Boop Ltd., "he awooo")

In the first example, the singular *he* is used with the plural *shlurp*, meaning "slurp." In the second example, the plural Doggo-speak verb *awooo*, loosely meaning "howl" is inconsistent with the singular *he*.

4.5 Possessive Mismatch

Rarely, *he* can be used in place of *his*, as below.

- "Uh oh looks like lil corgo did a take over he bed? Heck" (Floof Bork Snoot 'N' Boop Ltd., "Uh oh looks like")

This rule cannot be used with the Hims as a Possessive rule. Both would attempt to change the possessive pronoun *his* in the pre-transformation sentence. The Hims as a Possessive rule would change *his* to *hims*, while the Possessive Mismatch rule would change *his* to *he*.

4.6 Feature Descriptions

- Feature 3 - Subject/Object Mismatch: A sentence will be marked *true* if it contains the sequence [*him*, (NEG), VERB]
- Feature 4 - Hims: A sentence will be marked *true* if it contains *hims*
- Feature 5 - Number Mismatch: A sentence will be marked *true* if it contains the sequence [*he*, VERB-PLURAL]
- Feature 6 - Possessive Mismatch: A sentence will be marked *true* if it contains the sequence [*he*, NOUN]

5. SPELLING TRANSFORMATIONS

Many of the intentional spelling errors in Doggo-speak imitate typographical errors in which a single letter is omitted or inserted. Others involve the irregular transposition of letter ordering at the beginning of words or common letter replacements. Errors that appear infrequently or highly irregularly are not addressed in this analysis.

A selection of the spelling errors that appear in Doggo-speak appear below.

5.1 *-able*

The suffix *-able* is converted to *-abl* or, rarely, *-abork*. The word ending *-abork* appears to contain *bork*, a Doggo-speak verb for "bark." For example, *loveable* might be written as *loveabl* or *comfortable* might be written as *comfortabork*.

The change from *-able* to *-abl* could be seen as an imitation of a letter omission arising from fast typing. However, the change from *-able* to *-abork* conveys a more deliberate attempt to emphasize the dog-relatedness of the text.

5.2 *-ppy*

The word ending *-ppy* is converted to *-pp* or, rarely, *-ppi*. Most commonly, *happy* is written as *happ*.

5.3 *-ng/-nk*

In some instances, *g* becomes *k* following *n*. That is, *g* is optionally devoiced following *n*. For example, *strong* becomes *stronk* in "You all requested him, Lab Boi is the very good boi and please appreciate him and wish him to grow big and stronk" (Floof Bork Snoot 'N' Boop Ltd.,

"You all requested").

5.4 *-ck*

The word endings *-ck* and *-ct* can be converted to *-cc*, a pattern that appears in other internet terms.

- "2 golden bois do a fite over sticc" (Floof Bork Snoot 'N' Boop Ltd., "2 golden")
- "Protecc bol" (Floof Bork Snoot 'N' Boop Ltd. "Protecc")

5.5 Letter Duplication

Letters can be duplicated in a word for emphasis. Without other features of Doggo-speak in text containing this feature, the text would likely not be interpreted as Doggo-speak by humans.

Specifically, single-word captions containing only letter duplication, like "Geeez" and "Yyyyyyyyy???" (Bork Bork I Am Doggo) are not recognizable as examples of Doggo-speak on their own.

The two examples below are more recognizable as Doggo-speak, as they also contain examples of the Do Rule.

- "Someone does a case of the Mondays a haaaave" (Bork Bork I Am Doggo, "Someone does")
- "Duuuuude, doggo does a heckin' deep" (Bork Bork I Am Doggo, "Duuuuude")

5.6 Feature Descriptions

Four features will be formed from spelling transformations.

- Feature 7 - OOV Rate: The NLTK word corpus (Bird) will be used to tag out-of-vocabulary tokens. Each instance will be given a value from 0-1 for its percent of out-of-vocabulary tokens.
- Feature 8 - able: An instance will be marked *true* if it contains a word with a final *-abl*, if the same word with a final *-able* is a valid word in the corpus.
- Feature 9 - ppy: An instance will be marked *true* if it contains a word with a final *-pp*, if the same word with a final *-ppy* is a valid word in the corpus.
- Feature 10 - ng/nk: An instance will be marked *true* if it contains a word with a final *-nk*, if the same word with a final *-ng* is a valid word in the corpus.
- Feature 11 - cc: An instance will be marked *true* if it contains a word with a final *-cc*, if the same word with a *-ct* or *-ck* is a valid word in the corpus.
- Feature 12 - Letter Duplication: An instance will be marked *true* if it contains a sequence of 3 or more identical letters in a single word.

6. CAPITALIZATION RULES

While irregular capitalization is a common feature of informal text, particularly online, it also appears with a high frequency in Doggo-speak, usually in sentences that contain other features of Doggo-speak.

6.1 Capitalization for Emphasis

Entire words or phrases are capitalized for emphasis in sentences, as in the examples below.

- "SHOOOOB wants the Yum juice. Hooman
just h*cking p r o v i d e" (Floof Bork Snoot 'N' Boop Ltd., "SHOOOOB")
- "oh GOSH what have you DONE chef shoob!>!?!!" (Floof Bork Snoot 'N' Boop Ltd.,
"oh GOSH")

6.2 Inverted Capitalization

Inverted capitalization is sometimes present in the first word of a sentence in Doggo-speak. This type of capitalization mimics a typographical error in which a user's Caps Lock is off when the sentence starts and is incorrectly turned on after the first character. This results in the first letter of a word being lowercase while all following letters in that word are uppercase, as in "sOME History for you" (Floof Bork Snoot 'N' Boop Ltd. "sOME History").

6.3 Adjacent Capitalization

A mistake commonly seen in fast-typed text is the accidental capitalization of letters adjacent to a capital letter, especially at the start of a sentence. This is common in Doggo-speak. For example, two of the three sentences in "WE introduce to you, the Samoyed. Considering doing

more of these. WOULD u wanna see?" (Floof Bork Snoot 'N' Boop Ltd., "WE introduce") begin with words containing adjacent capitalization.

This capitalization mimics an error in which a user is typing quickly and turns Caps Lock off one character too late. It most often occurs at the beginning of a piece of text or in the first word of a sentence.

6.4 Omitted Capitalization

Capitalization is often omitted entirely at the beginning of sentences. This feature is common in both Doggo-speak and informal writing online.

6.5 Feature Descriptions

Four features will record non-standard capitalization. *A* stands for a capital letter and *a* stands for a lowercase letter in these feature descriptions.

- Feature 13 - Capitalization for Emphasis: A value from 0-1 will be assigned for the ratio of capital letters in the sentence to the total number of letters in the sentence
- Feature 14 - Inverted Capitalization: An instance will be marked *true* if any word in the sentence contains the pattern [aA₁]
- Feature 15 - Adjacent Capitalization: An instance will be marked *true* if any word in the sentence contains the pattern [AA₁a₀]
- Feature 16 - Omitted Capitalization: An instance will be marked *true* if any sentence in the text begins with a lowercase letter

7. CLASSIFICATION OF DOGGO-SPEAK

Using features described in the previous analysis as inputs to five machine learning tools, text was classified as *Doggo-speak* or *Not Doggo-speak*.

Two-hundred instances of Doggo-speak were included as positive examples (Floof Bork Snoot 'N' Boop Ltd.; Bork Bork I Am Doggo; Ding de la Doggo). Two-hundred instances of pet-related Amazon product reviews (He; McAuley; McAuley et al.) were included as negative examples of Doggo-speak. These reviews were chosen for their contextual similarity to the text and their semi-informal nature.

Each of the features of Doggo-speak were assigned as described in the previous feature-specific sections. Each feature vector contained values for the sixteen features described in the previous analysis. This resulted in a total of 400 pieces of text, each with sixteen features. For example, each piece of text was assigned an empty feature vector, as below.

[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]

Each feature was then computed for the text. If a feature is marked as *true* for that piece of text, the corresponding element of the feature vector was updated to 1. For the rate type features, a ratio was computed and stored in the vector element corresponding to that feature. The vector below is an example that has been marked *true* for features two, three, and fifteen. It also has a rate recorded for feature seven.

[0, 1, 1, 0, 0, 0, 0.45, 0, 0, 0, 0, 0, 0, 0, 1, 0]

A major difference in the Doggo-speak instances and the reviews is in length of the text. Most of the reviews were significantly longer than the Doggo-speak texts. However, only two features measure rates that involve the length of the text. In fact, this difference in length provides more opportunity for the examples of *Not Doggo-speak* to be marked *true* for fourteen of the sixteen features.

Using Python’s Scikit-learn library (Pedregosa et al.), five machine learning algorithms were trained and then tested. Their performance was compared to that of a default classifier that assigns predictions based on training set class frequency (“sklearn.dummy”). The learners and non-default parameters used are listed in table 1. The names in the Shortened Name column will be used throughout the remainder of this paper when specifying classifier names.

These learners were chosen to represent a variety of machine learning paradigms and a range of complexity. Complex methods like AdaBoost and RandomForest were expected to have better results than the NB and Decision Tree learners. The MLP classifier, a multi-layer perceptron neural network classifier, was included as the only neural network learner. However, the small dataset size was a concern when training and testing this classifier.

Table 1

Learners Included in Project

Algorithm	Shortened Name	Non-Default Parameters
MultinomialNB	NB	
MLPClassifier	MLP	
AdaBoostClassifier	AdaBoost	<i>n_estimators=70</i>
DecisionTreeClassifier	DecisionTree	<i>max_depth=20</i>
RandomForestClassifier	RandomForest	<i>n_estimators=50</i>

The learners were tested using 10-fold cross-validation (see table 2). For each fold, classes in both training and testing were intentionally balanced, though all data was randomized before and after creating splits for the folds.

Table 2

Classifier Accuracy by Fold

	1	2	3	4	5	6	7	8	9	10	Avg
Dummy	0.55	0.55	0.38	0.65	0.42	0.47	0.60	0.50	0.47	0.50	0.51
NB	0.78	0.55	0.75	0.82	0.60	0.55	0.57	0.65	0.72	0.65	0.66
MLP	0.93	0.85	0.88	0.90	0.85	0.78	0.80	0.88	0.88	0.88	0.86
AdaBoost	0.90	0.93	0.88	0.90	0.95	0.90	0.90	0.88	0.90	0.88	0.90
DecisionTree	0.88	0.85	0.80	0.95	0.93	0.85	0.85	0.80	0.88	0.88	0.87
RandomForest	0.90	0.93	0.90	0.93	0.97	0.93	0.88	0.90	0.95	0.85	0.91

All classifiers outperformed the Dummy classifier by a minimum of 0.15 in accuracy. The highest performing classifier was the RandomForest classifier, with an average accuracy across all folds of 0.91. It exceeded the Dummy classifier baseline by 0.40. The RandomForest classifier also had the highest or tied for the highest accuracy on six out of ten folds.

The AdaBoost classifier was the second highest performer, with an average accuracy of 0.90.

The lowest performing classifier was the NB classifier with an average accuracy of 0.66. It was the only classifier that did not have the highest accuracy in any fold.

The RandomForest classifier also had the highest F1 score, 0.91 (see table 3). This exceeds the F1 score of the Dummy classifier by 0.35.

These results were consistent with expectations. AdaBoost and RandomForest classifiers outperformed the NB and DecisionTree classifiers. Despite the small dataset size, the MLP classifier was able to achieve an F1 score only 0.02 lower than the AdaBoost classifier.

Table 3

Precision, Recall, and F1 Scores

	Precision	Recall	F1 Score
Dummy	0.53	0.57	0.56
NB	0.73	0.55	0.62
MLP	0.80	0.97	0.88
AdaBoost	0.90	0.91	0.90
DecisionTree	0.87	0.87	0.87
RandomForest	0.92	0.91	0.91

Using the feature importance method of the RandomForest classifier, input features are mapped to their importance in classification (see table 4).

This importance data shows that the four most important features in distinguishing Doggo-speak from semi-informal English reviews are as follows.

1. The out-of-vocabulary rate
2. The ratio of capital letters to all letters in a piece of text
3. The usage of *heck*
4. The presence of the Do Rule transformations

Using these feature importance scores, no features were considered unimportant to classification.

The least important features were as below.

1. The word ending *-able* written as *-abl* or *-abork*
2. The presence of *hims*
3. Sentence-initial adjacent capitalization

Table 4

Feature Importance Values

Feature	Importance Score
1 - Do Rule	0.0266
2 - 'Heck'	0.0520
3 - Subject/Object Mismatch	0.0017
4 - Hims	0.0003
5 - Number Mismatch	0.0044
6 - Possessive Mismatch	0.0112
7 - OOV Rate	0.5368
8 - able	0.0002
9 - ppy	0.0089
10 - ng/nk	0.0146
11 - cc	0.0009
12 - Letter Duplication	0.0088
13 - Capitalization for Emphasis	0.3031
14 - Inverted Capitalization	0.0104
15 - Adjacent Capitalization	0.0070
16 - Omitted Capitalization	0.0131

The out-of-vocabulary rate feature, while useful in classifying Doggo-speak as compared to

semi-informal reviews, would likely be less helpful in the classification of Doggo-speak as compared to less formal text, particularly other meme languages. Additionally, this feature is a rate-type feature, for which the chosen review dataset may be at a disadvantage due to the overall length of the texts.

To test the impact of removing this feature, the learners were re-trained with the remaining fifteen features. Removing the out-of-vocabulary feature did result in a decrease in the average F1 score across all tested classifiers (see table 5).

Table 5

F1 Scores Before and After Out-of-Vocabulary Feature Removal

	Presence of Out-Of-Vocabulary Feature	
	Included	Not Included
Dummy	0.56	0.51
NB	0.62	0.61
MLP	0.88	0.76
AdaBoost	0.90	0.83
DecisionTree	0.87	0.75
RandomForest	0.91	0.81

The F1 score for the RandomForest classifier dropped significantly with the removal of the out-of-vocabulary rate feature, a decrease of 0.1. The highest performing learner without this feature is the AdaBoost classifier. It achieved an F1 score of 0.83. Despite lower performance without the out-of-vocabulary feature, all classifiers still exceed the Dummy baseline by at least 0.1 and the AdaBoost classifier exceeded the baseline by 0.32.

8. CONCLUSIONS

All but one of the learners in this project achieved high F1 scores, at or above 0.87, on the binary classification task. Even with the removal of the out-of-vocabulary feature, all classifiers except one achieved F1 scores at or above 0.75.

However, given that the two most important features for the most successful learner were related to out-of-vocabulary tokens and capitalization, the classifiers discussed may be less successful in distinguishing of Doggo-speak from other internet languages that share similar misspellings, vocabulary additions, and capitalization errors.

Further research on this topic could include expansion of the datasets and the training of a second model to address the classification of Doggo-speak in comparison to the informal meme languages in Snek, LOLCat, and Doge. Additional conventions of Doggo-speak could also be explored. For example, Doggo-speak contains phonetic spellings and word omissions, but with extreme irregularity. An analysis of such patterns along with the specialized Doggo-speak vocabulary not included in this research would be a next step toward fully understanding Doggo-speak.

The features described in this paper were representative of Doggo-speak, as shown by their sufficiency for the task of identifying Doggo-speak using classifiers in multiple machine learning paradigms. In future research, exploration of additional features and comparison against other meme languages would provide a more comprehensive understanding of Doggo-speak.

APPENDIX A: NOTATION

- **Subscripting:** A subscript of 0, as in C_0 , refers to zero or more instances of the item of the preceding type. A subscript of 1 refers to one or more instance of an item.
- **Parenthesis:** An item in parenthesis refers to a single optional instance of that item. For example, (NOUN) would mean a single optional noun in a sequence.
- **Vocabulary Additions:** For part-of-speech tagging, some Doggo-speak specific terms are added to a special part-of-speech dictionary:
 - *happ*: [NOUN, ADJ]
 - *heck*: [VERB, NOUN]
 - *hecking*: [ADJ]

WORKS CITED

“Bamboozle.” *Know Your Meme*. Literally Media Ltd. knowyourmeme.com/memes/bamboozle.

Accessed 28 April 2018.

Bird, Steven, Edward Loper, and Ewan Klein. *Natural Language Processing with Python*.

O’Reilly Media Inc., 2009.

Boddy, Jessica. “Dogs Are Doggos: An Internet Language Built Around Love for the Puppies.”

NPR, 23 April 2017, [npr.org/sections/alltechconsidered/2017/04/23/524514526/dogs-are-](http://npr.org/sections/alltechconsidered/2017/04/23/524514526/dogs-are-doggos-an-internet-language-built-around-love-for-the-puppies)

[doggos-an-internet-language-built-around-love-for-the-puppies](http://npr.org/sections/alltechconsidered/2017/04/23/524514526/dogs-are-doggos-an-internet-language-built-around-love-for-the-puppies). Accessed 5 March 2018.

Bork Bork I Am Doggo. *Facebook.com*. [facebook.com/borkborkiamdoggo](https://www.facebook.com/borkborkiamdoggo). Accessed 4 Feb.

2018.

Bork Bork I Am Doggo. "Doin' a heckin' Christmas..." *Facebook.com*, 1 Dec. 2017.

[facebook.com/borkborkiamdoggo/photos/a.1713311222314373.1073741829.1633346156977547](https://www.facebook.com/borkborkiamdoggo/photos/a.1713311222314373.1073741829.1633346156977547)

[/1890037414641752/?type=3](https://www.facebook.com/borkborkiamdoggo/photos/a.1713311222314373.1073741829.1633346156977547). Accessed 4 Feb. 2018.

Bork Bork I Am Doggo. "Duuuuude, doggo does a heckin' deep." *Facebook.com*, 29 Jan. 2018.

[facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547](https://www.facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547)

[/1922845948027565/?type=3](https://www.facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547). Accessed 4 Feb. 2018.

Bork Bork I Am Doggo. "Floof does a heckin' tuck..." *Facebook.com*, 9 Dec. 2017.

[facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547](https://www.facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547)

[/1894509694194524/?type=3](https://www.facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547). Accessed 4 Feb. 2018.

Bork Bork I Am Doggo. "Floofaid! Ams the World..." *Facebook.com*, 17 Dec. 2017.

facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547/1898776830434477/?type=3. Accessed 4 Feb. 2018.

Bork Bork I Am Doggo. "Geeez." *Facebook.com*, 9 Dec. 2017.

facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547/1894510104194483/?type=3. Accessed 4 Feb. 2018.

Bork Bork I Am Doggo. "Happ New Yeer!! Be safe..." *Facebook.com*, 31 Dec. 2017.

facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547/1906798159632344/?type=3. Accessed 4 Feb. 2018.

Bork Bork I Am Doggo. "Only 5 days left in the Derp for Charity drive..." *Facebook.com*, 17 Jan. 2018. facebook.com/borkborkiamdoggo/posts/1915954442050049. Accessed 4 Feb. 2018.

Bork Bork I Am Doggo. "Someone does a case of the..." *Facebook.com*, 22 Jan. 2018.

facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547/1918640131781480/?type=3. Accessed 4 Feb. 2018.

Bork Bork I Am Doggo. "Special Fan Submission Borkathon..." *Facebook.com*, 27 Dec. 2017.

facebook.com/borkborkiamdoggo/photos/a.1633358493642980.1073741828.1633346156977547/1904254643220029/?type=3. Accessed 4 Feb. 2018.

Bork Bork I Am Doggo. "Yyyyyyyyyy???" *Facebook.com*, 12 Dec. 2017.

facebook.com/borkborkiamdoggo/photos/a.1713311222314373.1073741829.1633346156977547/1896145327364294/?type=3. Accessed 4 Feb. 2018.

Chayka, Kyle. "Wow this is Dog." *The Verge*. Vox Media, Inc., 31 Dec. 2013.

theverge.com/2013/12/31/5248762/doge-meme-rescue-dog-wow. Accessed 28 Apr. 2018.

Ding de la Doggo. *Facebook.com*, facebook.com/dingdeladoggo. Accessed 4 Feb 2018.

“Doggo.” *Know Your Meme*. Literally Media Ltd. knowyourmeme.com/memes/doggo. Accessed 5 March 2018.

Floof Bork Snoot 'N' Boop Ltd. *Facebook.com*. facebook.com/doggosbeingdoggos. Accessed 4 Feb. 2018.

Floof Bork Snoot 'N' Boop Ltd. "#FREECLOUD Shoobmster has been bamboozled..." *Facebook.com*, 3 Dec. 2017.

facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889/5/1791788797787553/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "2 golden bois do a fite..." *Facebook.com*, 10 Nov. 2017.

facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889/5/1782575418708891/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "Aw heck German boii..." *Facebook.com*, 4 Dec. 2017.

facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889/5/1791906471109119/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "Bamboozled again!..." *Facebook.com*, 24 Dec. 2017.

facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889/5/1800628570236909/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "Clip clop neigh doggo meet pupper..." *Facebook.com*, 24 Jan.

2018.

facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889
5/1814249602208139/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "Doggo just doesn't have time..." *Facebook.com*, 5 Dec. 2017.

facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889
5/1792638144369285/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "Flowo make hims happ..." *Facebook.com*, 31 Dec. 2017.

facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889
5/1803734509926315/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "he awooo." *Facebook.com*, 24 Dec. 2017.

facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889
5/1800773813555718/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "Heck ur lyf." *Facebook.com*, 18 Dec. 2017.

facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889
5/1798262257140207/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "Hmm pupper is being pretty ambiguous..." *Facebook.com*, 12

Dec. 2017.

facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889
5/1795846767381756/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "oh GOSH what have you DONE..." *Facebook.com*, 16 Nov. 2017.

[facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889/5/1784963358470097/?type=3](https://www.facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889/5/1784963358470097/?type=3). Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "Oh mai hevans, he wish." *Facebook.com*, 8 Dec. 2017.

[facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889/5/1794209337545499/?type=3](https://www.facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889/5/1794209337545499/?type=3). Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "Protecc bol." *Facebook.com*, 24 Nov. 2017.

[facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889/5/1787999298166503/?type=3](https://www.facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889/5/1787999298166503/?type=3). Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "Pupper is ready for 2018..." *Facebook.com*, 3 Jan. 2018.

[facebook.com/doggosbeingdoggos/videos/1805223566444076/](https://www.facebook.com/doggosbeingdoggos/videos/1805223566444076/). Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "SHOOOOB wants the Yum juice..." *Facebook.com*, 8 Dec. 2017.

[facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889/5/1794352177531215/?type=3](https://www.facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889/5/1794352177531215/?type=3). Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "sOME History for you." *Facebook.com*, 19 Dec. 2017.

[facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889/5/1798509037115529/?type=3](https://www.facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889/5/1798509037115529/?type=3). Accessed 4 Feb. 2018.

Floof Bork Snoot 'N' Boop Ltd. "Uh oh looks like lil corgo..." *Facebook.com*, 15 Dec. 2017.

[facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889](https://www.facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889)

5/1796924523940647/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "WE introduce to you, the Samoyed..." *Facebook.com*, 5 Nov. 2017.

facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889
5/1780466048919828/?type=3. Accessed 4 Feb. 2018.

Floof Bork Snoot 'N' Boop Ltd. "What do yuo think frens..." *Facebook.com*, 20 Dec. 2017.

facebook.com/doggosbeingdoggos/photos/a.1702775906688843.1073741829.160094206353889
5/1799128757053557/?type=3. Accessed 4 Feb 2018.

Floof Bork Snoot 'N' Boop Ltd. "You all requested him..." *Facebook.com*, 26 Nov. 2017.

facebook.com/doggosbeingdoggos/photos/a.1655073254792442.1073741828.160094206353889
5/1789043251395441/?type=3. Accessed 4 Feb 2018.

Gillespie, Clay Michael. "UltraPRO Responds to Doge Trademark Uproar." *CCN*, 24 June 2014.
ccn.com/ultrapro-responds-doge-trademark-uproar/. Accessed 5 March 2018.

Graham, Elyse. "The weird underside of DoggoLingo." *Oxford Dictionaries*. Oxford University Press, 1 Aug. 2017. blog.oxforddictionaries.com/2017/08/01/doggolingo. Accessed 5 March 2018.

Greenwell, Megan. "Pet Project." *Esquire*. Hearst Communications, Inc., 14 May 2017.
esquire.com/lifestyle/a54940/we-rate-dogs-matt-nelson-interview/. Accessed 5 March 2018.

Hall, Mat. "Undertale - Snowdin explored: Mysterious door, puzzle solutions, and how to beat Doggo, Dogi, Greater Dog bosses." *Eurogamer*. Gamer Network, 25 Aug. 2017.

eurogamer.net/articles/2017-08-25-undertale-walkthrough-pacifist-guide-4873?page=4.

Accessed 22 April 2018.

He, Ruining, and Julian McAuley. "Ups and downs: Modeling the visual evolution of fashion trends with one-class collaborative filtering." *WWW*, 2016.

Hopewell, Luke. "YouTube Has an Adorable Doge Mode." *Gizmodo.com.au*. Allure Media, 21 Nov. 2013. gizmodo.com.au/2013/11/youtube-has-an-adorable-doge-mode/. Accessed 24 April 2018.

Macdonald, Cheyenne. "Do YOU speak Doggo? From pupperinos to woofers, researchers reveal the bizarre language dog fans have evolved online." *Dailymail.com*. Associated Newspapers Ltd., 28 April 2017. dailymail.co.uk/sciencetech/article-4453708/Do-speak-Doggo-Researchers-reveal-online-language.html. Accessed 5 March 2018.

McAuley, Julian. "Amazon Product Data." [Jmcauley.ucsd.edu/data/amazon/](http://jmcauley.ucsd.edu/data/amazon/). Accessed 12 March 2018.

McAuley, Julian, Christopher Targett, Qinfeng Shi, and Anton van den Hengel. "Image-based recommendations on styles and substitutes." *SIGR*, 2015.

"sklearn.dummy.DummyClassifier." *Scikit-learn*. scikit-learn.org/stable/modules/generated/sklearn.dummy.DummyClassifier.html. Accessed 5 March 2018.

Pedregosa et al. "Scikit-learn: Machine Learning in Python." *JMLR* Vol 12, 2011, pp. 2825-2830.

Valdez, Andrea. "Meme's Best Friend: The Rise of 'Doggo'." *Wired*. Condé Nast, 10 Jan. 2018.
wired.com/story/rise-of-doggo. Accessed 5 March 2018.

"Words We're Watching: 'Doggo'." *Merriam Webster*. Merriam-Webster, Inc. merriam-
webster.com/words-at-play/words-were-watching-doggo. Accessed 5 March 2018.