Reddit Posts Analysis with Natural Language Processing

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Executive Summary

Who we are

- ***Smart Pet***, established in **August 2017** by *Florian Combelles*
- Passion for animals with expertise from former vets, pet store owners and animal shelter volunteers
- Worked with organisations and companies such as:
  - **SPCA**
  - **AVA**
  - **Petslovers**

SMART PET

Our mission:
"We care for them"

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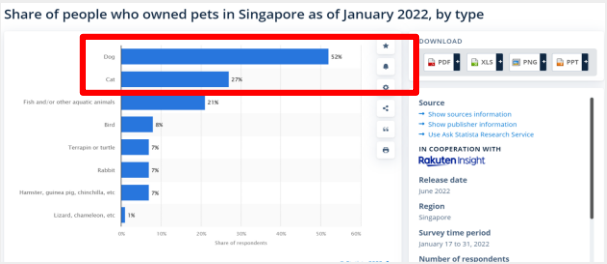
Problem Statement

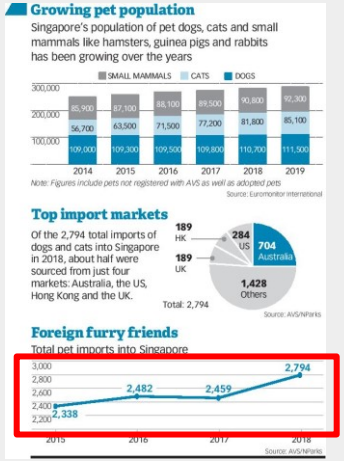
The challenge at hand

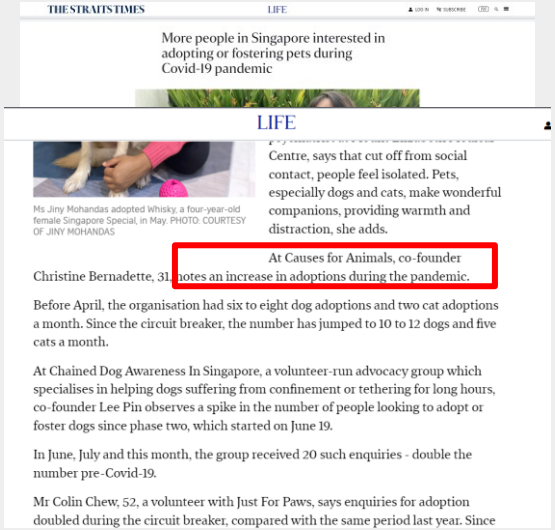
Background

- Most common pets in Singapore
  - **Dogs - 52%**
  - **Cats - 27%**

Increased interest in pet ownership → Rise of inexperienced pet owners






THE STRAITS TIMES LIFE

More people in Singapore interested in adopting or fostering pets during Covid-19 pandemic

LIFE

Ms Jiny Mohandas adopted Whisky, a four-year-old female Singapore Special, in May. PHOTO: COURTESY OF JINY MOHANDAS

Centre, says that cut off from social contact, people feel isolated. Pets, especially dogs and cats, make wonderful companions, providing warmth and distraction, she adds.

At Causes for Animals, co-founder Christine Bernadette, 31, notes an increase in adoptions during the pandemic.

Before April, the organisation had six to eight dog adoptions and two cat adoptions a month. Since the circuit breaker, the number has jumped to 10 to 12 dogs and five cats a month.

At Chained Dog Awareness In Singapore, a volunteer-run advocacy group which specialises in helping dogs suffering from confinement or tethering for long hours, co-founder Lee Pin observes a spike in the number of people looking to adopt or foster dogs since phase two, which started on June 19.

In June, July and this month, the group received 20 such enquiries - double the number pre-Covid-19.

Mr Colin Chew, 52, a volunteer with Just For Paws, says enquiries for adoption doubled during the circuit breaker, compared with the same period last year. Since

With an influx of **inexperienced** pets owners **overly reliant** on vets and pet store, how can we better optimize everyone's time?

Stakeholders' Concerns

- Lack of local resources regarding information on:
  - Licensing, upkeep costs, aftercare

How does it affect you?

Decrease in work efficiency

- Pet store owners occupied answering queries

Overbooking of Vet appointments

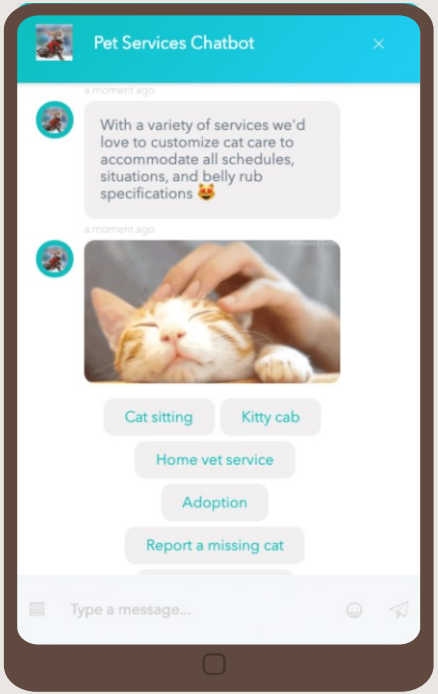
- Pet owners coming in for minor enquiries/non-emergencies

More animals abandoned

- Animals abandoned after pandemic are sent to the shelters

Our mobile app (beta)

- **Pet Companions**, mobile application (currently in beta) that can offer pet owners information through:
  - AI-powered chatbot
    - First level of customer inquiry
    - Source of information for pet owners
  - Recommends articles based on classification of queries
  - A knowledge-bank filled with information sourced from vets, pet experts and users



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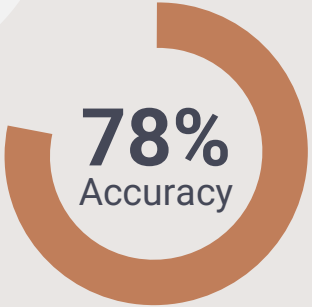
Methodology

How we've been doing it

Existing model - K-Nearest Neighbours (KNN)



How does this work?

- Classification of observation depends on the number of surrounding data points taken as reference

E.g. Classification of ‘Resource guarding’:

- If K = 3 → Dog
- If K = 5 → Cat

Potential model - Naive Bayes

P (dog-related post): 0.60

15	10	4
Toy	Walk	Night

10	2	9
Toy	Walk	Night

P (cat-related post): 0.40

- Classification of the text post is based on comparing the conditional probabilities of the it belonging to either r/CatAdvice or r/DogAdvice

“night walk”

- P(Cat | ‘night walk’) **vs** P(Dog | ‘night walk’)

Potential model - Logistic Regression

- Each word/token within the model are weighted according to their importance to the respective categories
- The model will generate the probabilities for each category
- The text post will be labelled according to the category with the highest probability

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Data Collection & Cleaning

How we collect and clean the information

Overview of data collected

- *r/CatAdvice* and *r/DogAdvice*
- User-generated data scrapped using Pushshift API

	r/CatAdvice	r/DogAdvice
Period of Posts	12 Oct - 24 Nov	25 Aug - 24 Nov
No. of Posts	4,247	4,000
Size of Community	119K	66.5K

Cleaning process

Content Management

- Posts w/o main text were dropped
- Text data for analysis: Main text + Title
- Both categories have 2,300 data points for analysis

Word Processing

- Removed stopwords, punctuation, digits, random characters, URLs
- Transformed each word to lower-case and lemmatise*

Removed Common Terms

- Words that are related to either categories e.g. “dog”, “cat”, “kitten”, “puppy”
- Words that are common to both categories e.g. “vet”, “veterinarian”, “month”, “old”

*Lemmatisation is the grouping of inflected forms of similar words so that they can be analysed as a single term (often as the root word)

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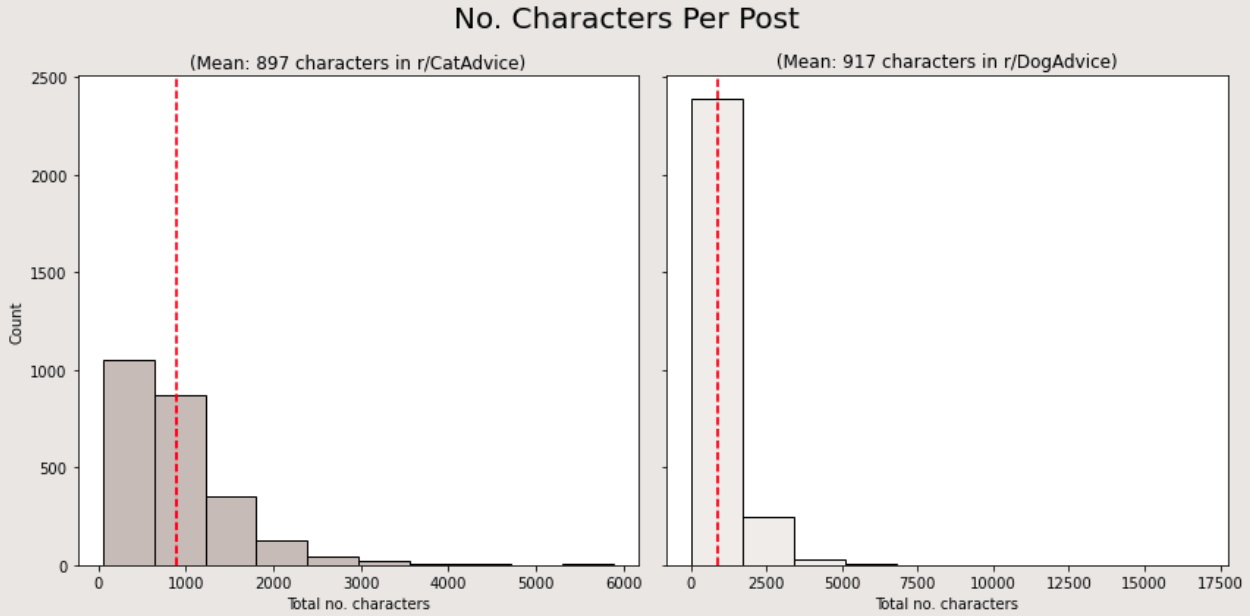
Exploratory Data Analysis

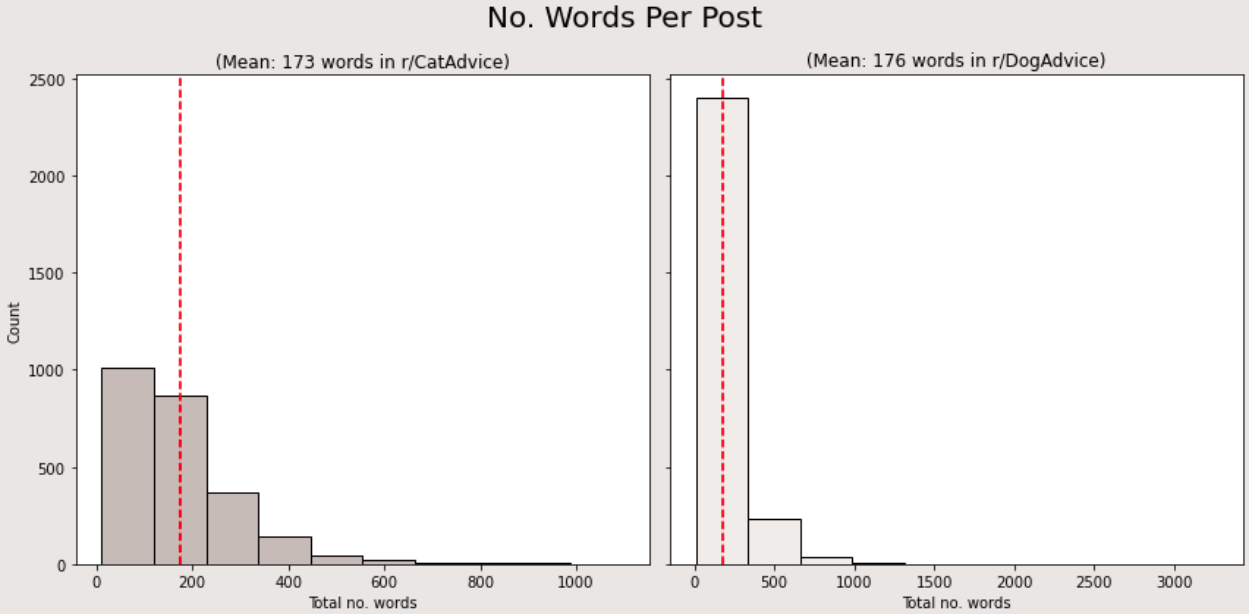
Zooming in on our data

Higher average character count in r/DogAdvice



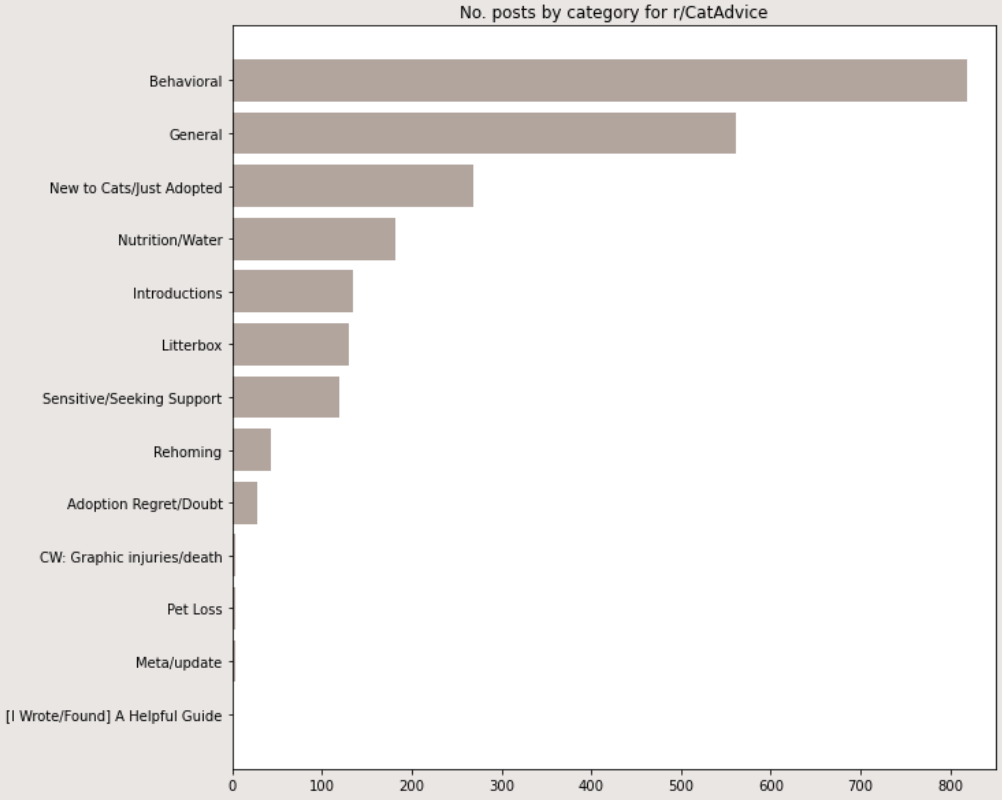
- **Maximum no. characters:** 5,885 in r/CatAdvice & 16,898 in r/DogAdvice
- **Minimum no. characters:** 56 in r/CatAdvice & 39 in r/DogAdvice

Similar word count average in both subreddits



- **Maximum no. words:** 1,097 in r/CatAdvice & 3,267 in r/DogAdvice
- **Minimum no. words:** 11 in r/CatAdvice & 9 in r/DogAdvice

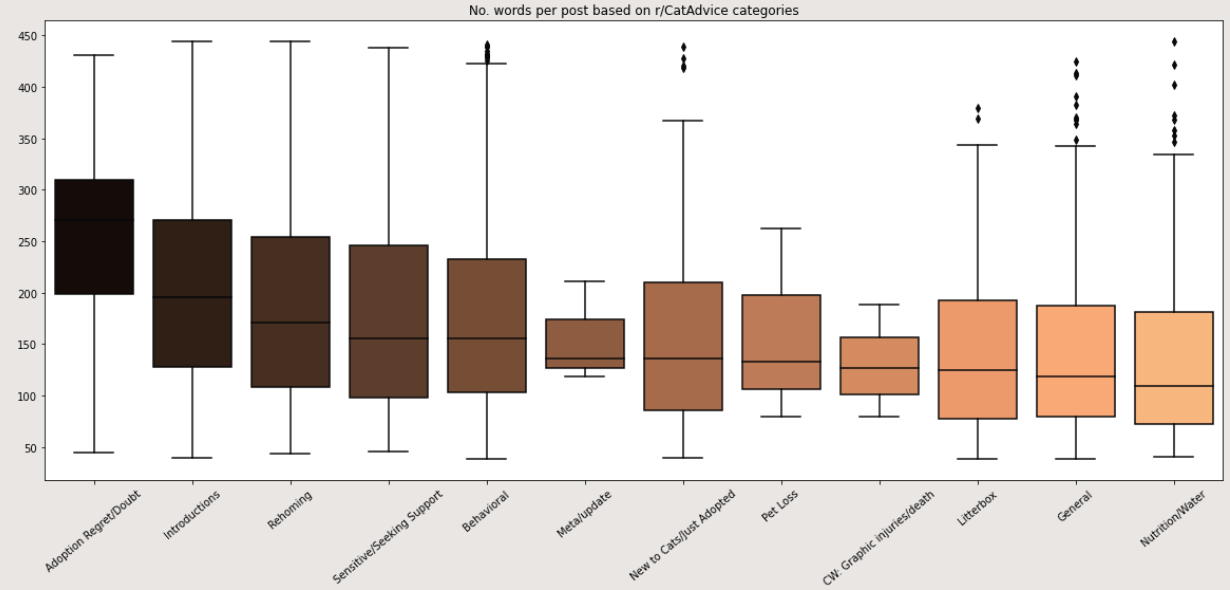
Behavioral queries tops r/CatAdvice discussion



Top topics tagged:

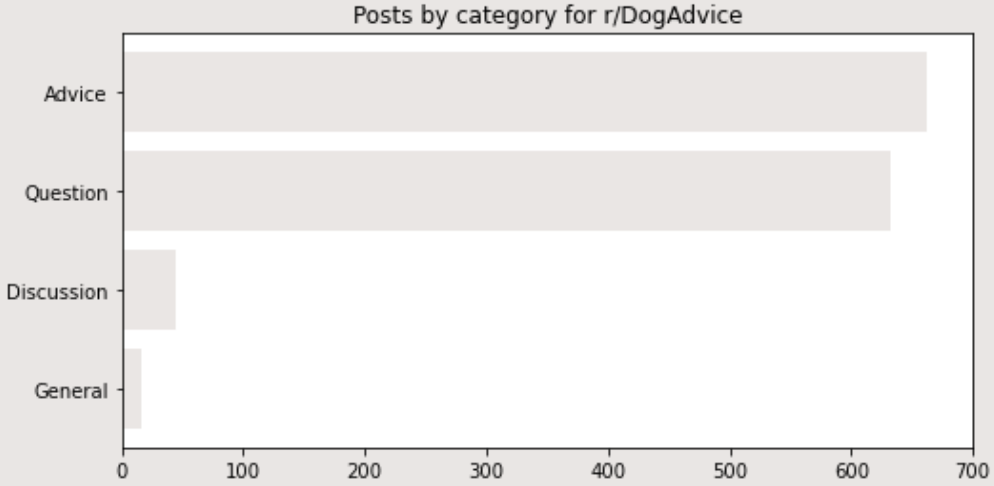
- **Behavioral:** 818 posts
- **General:** 561 posts
- **New Cats/Newly adopted:** 269 posts

Highest word count average on Adoption Regret/Doubt



- **Adoption Regret/Doubt:** 248 average no. words
- **Introductions:** 206 average no. words
- **Behavioral:** 175 average no. words

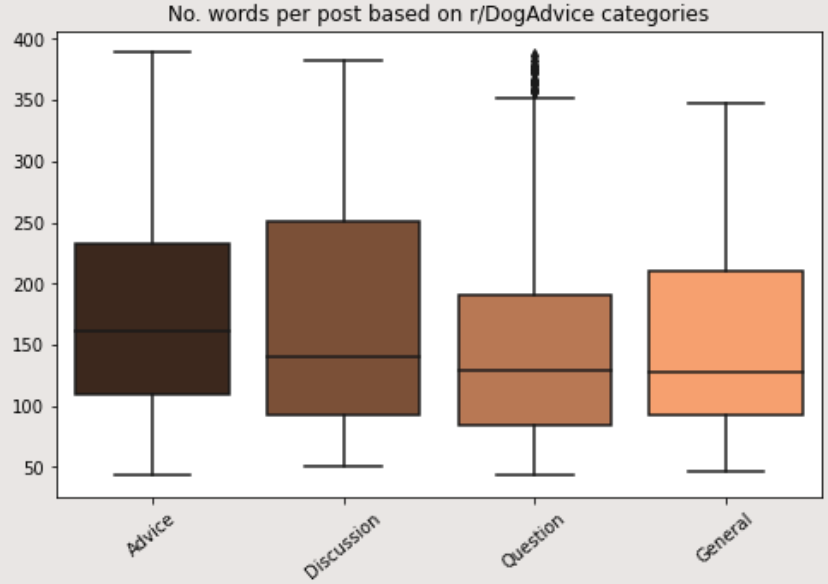
More general categories in r/DogAdvice



Top topics tagged:

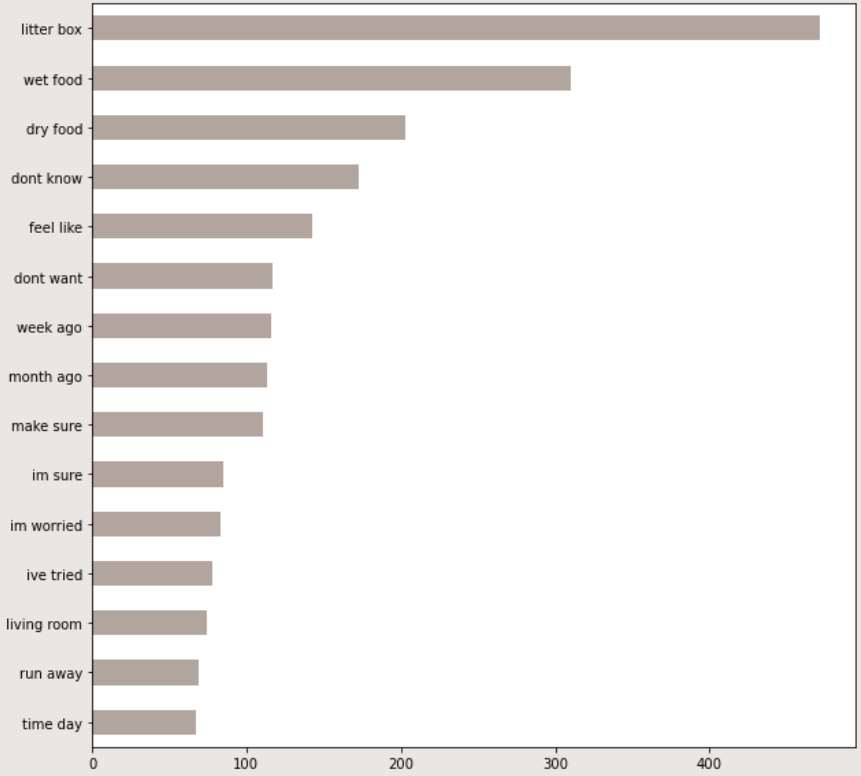
- **Advice:** 662 posts
- **Question:** 632 posts

Highest word count average for Advice category



- **Advice:** 177 average no. words
- **Discussion:** 174 average no. words

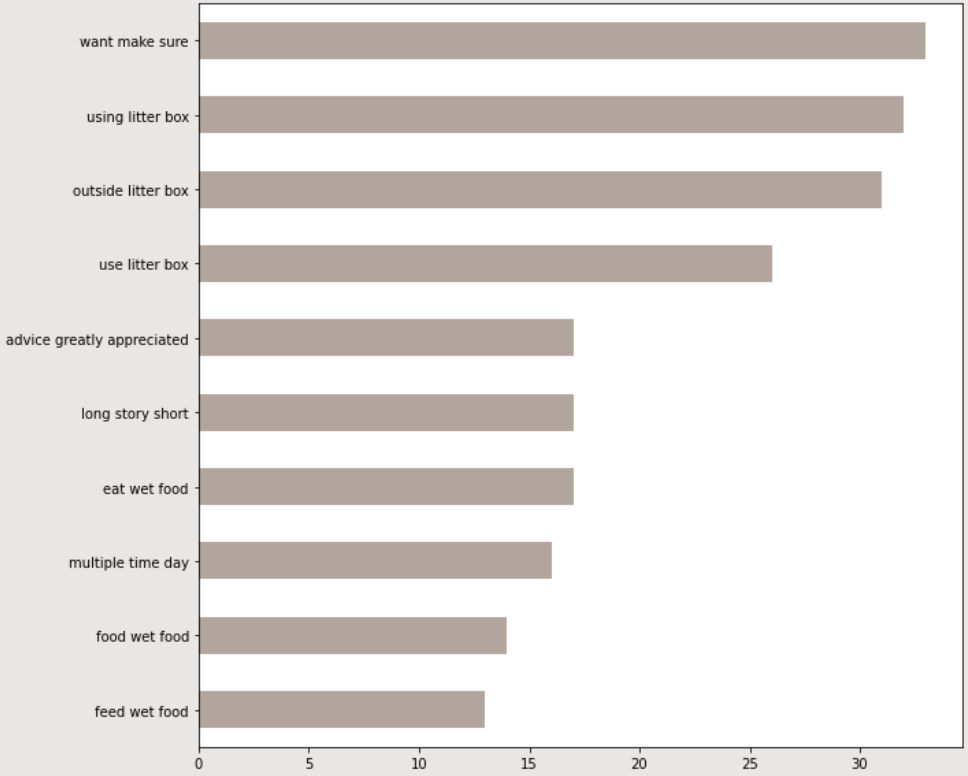
Top 2-word queries in r/CatAdvice



- ‘Litter box’
- ‘Wet food’
- ‘Dry food’

Users are concerned with their cats’ environment and nutrition.

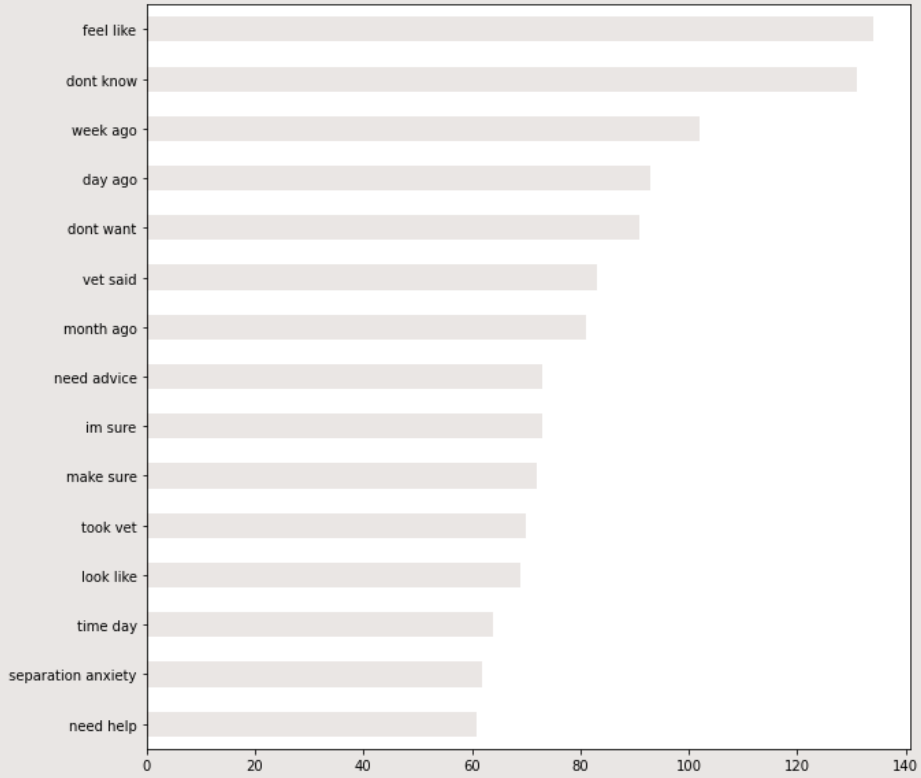
Top 3-word queries in r/CatAdvice



- ‘Using litter box’
- ‘Outside litter box’
- ‘Use litter box’

This reaffirms that users are most concerned with their cats’ environment.

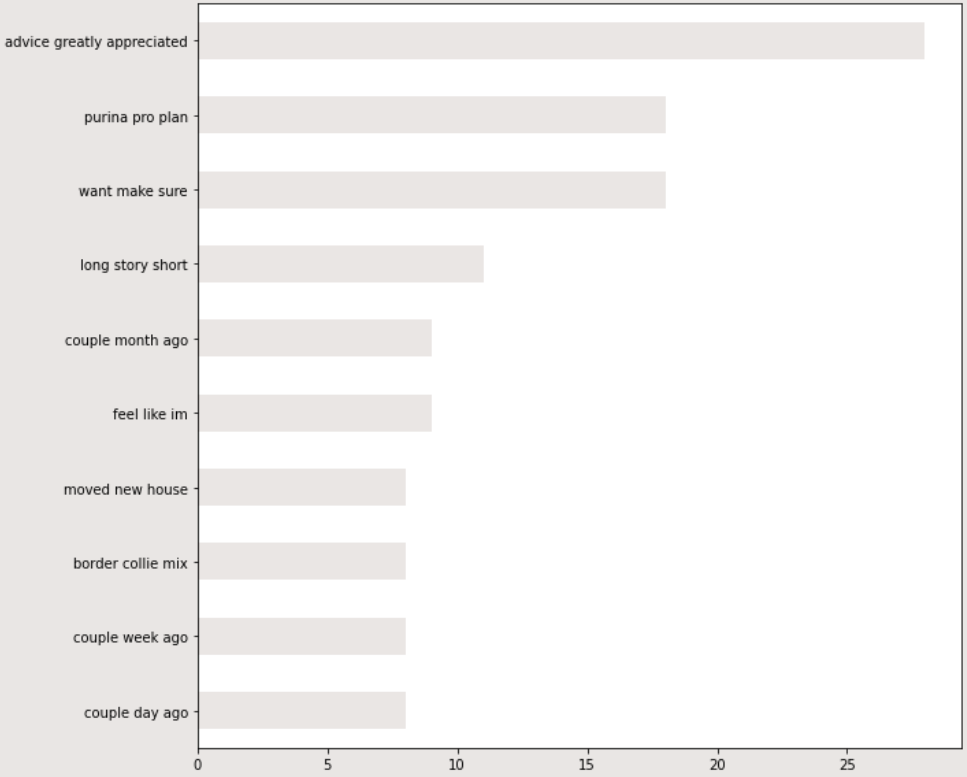
Top 2-word queries in r/DogAdvice



- ‘Feel like’
- ‘Don’t know’
- ‘Need advice / help’
- ‘Separation anxiety’

Users seem mostly uncertain about the issues faced. The only issue mentioned is ‘separation anxiety’.

Top 3-word queries in r/DogAdvice



- ‘Advice greatly appreciated’
- ‘Purina pro plan’
- ‘Want make sure’

This reaffirms users in this forum could be more uncertain and may require more support.

‘Purina pro plan’ was mentioned often - this is a formula to improve dog’s digestion.

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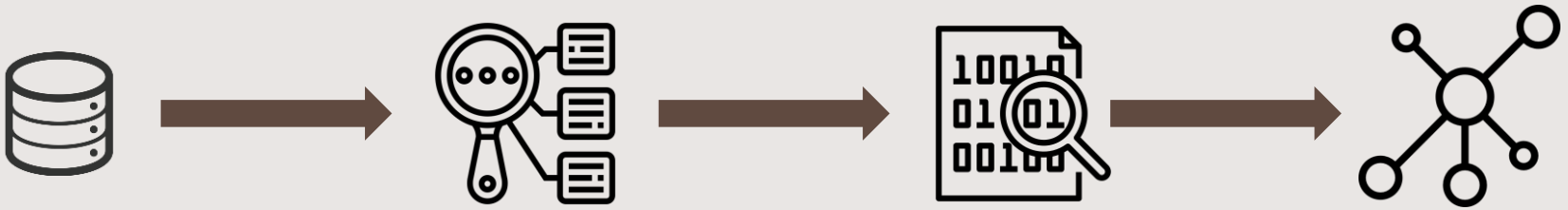
Classification Models

Processing our data

Data preparation and modelling



Split to 2 datasets for model training and testing

Data transformation to convert words to numbers

Train and evaluate models

The training models and measure of success

Classification Models:

- Logistic Regression
- Naive Bayes (Multinomial, Bernoulli and Gaussian)

Evaluation Metrics:

- Accuracy Score
  No. of observations classified correctly / Total positive and negative observations
- F1 score
  Balance of precision and recall on positive observations

What we're looking for:

⬆ Higher Accuracy Score

⬆ Higher F1 score

⬆ Better Model Performance

Cat or dog?

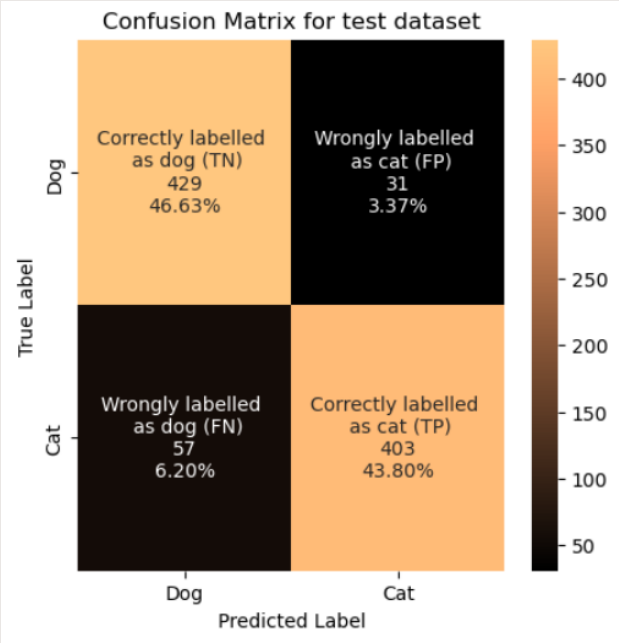
Multi Naive Bayes achieved 90% accuracy & F1 score

	Model	Data transformation to	Accuracy Score for train	Accuracy Score for test	F1 score
0	KNN (Baseline)	Tf-idf	0.865489	0.781522	0.789529
1	MultiNB	Tf-idf	0.955978	0.890217	0.891515
2	MultiNB	single_word	0.958152	0.902174	0.900222
3	MultiNB	2-word phrase	0.999728	0.840217	0.847668
4	BernNB	Tf-idf	0.963587	0.900000	0.897778
5	BernNB	single_word	0.963587	0.900000	0.897778
6	BernNB	2-word phrase	1.000000	0.825000	0.815578
7	GausNB	Tf-idf	0.971739	0.742391	0.751832
8	GausNB	single_word	0.964402	0.763043	0.777551
9	GausNB	2-word phrase	0.844565	0.773913	0.742574
10	Logistic Regression	Tf-idf	0.960054	0.885870	0.880546
11	Logistic Regression	single_word	0.999728	0.880435	0.878587
12	Logistic Regression	2-word phrase	1.000000	0.781522	0.759857
13	MultiNB with hyperparameter tuning	single_word	0.903261	0.904348	0.901566

Selected model for tuning

Best result post-tuning

90% of predictions are correctly labeled



Highly accurate model

- Total Observations: 920
- Correct classifications: 832

Low Misclassification

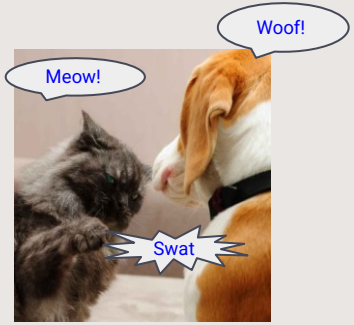
- Wrongly labeled as dog: 6.2%
- Wrongly labeled as cat: 3.3%

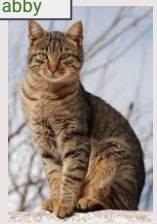
Distinct words between cats and dogs

Top 10 words for cats
Meowing
Meow
Swat
Litterbox
Galaxy
Jackson
Feliway
Diffuser
Tabby
Resident

Behaviours

Cat types



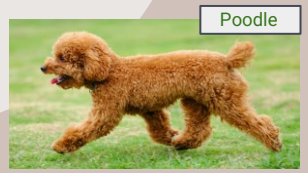


Top 10 words for dogs
Bark
Trainer
Flea
Diarrhea
Infection
Treatment
Collie
Poodle
Terrier
Daycare

Behaviours

Medical

Dog types



7

Conclusion and Recommendations

Our key takeaways

Model Results Recap

Number of posts

Extensive content that allow our model to be trained accurately

Accuracy

Less than 10% of content is misclassified

Increase in accuracy

New model is outperforming previous model by 12%

Limitations

Article availability

- Limited availability of articles at launch
  - Rapidly expand based on popular topics and what are people looking for

Cat/Dog specific

- Cat and dogs are the most popular pets
  - Model currently limited to cat and dog classification

Context

- Recommendations and articles are based on global trends
  - Not specific to Singapore

Conclusion

Problem statement:
With an influx of inexperienced pets owners overly reliant on vets and pet store, how can we better optimize everyone's time?

Refocus your business

- Focus on the core of your business
  - Treating pets
  - Driving sales growth

Reduce dependance

- Provide users with extensive and comprehensive articles to cover all their basic needs

Leverage insight

- Get information on customers/patients
- Based on their app usage

Increase care

- Reduce abandonment rate

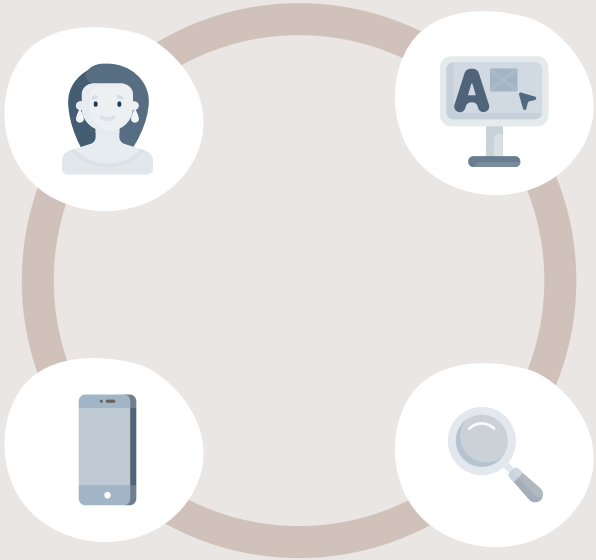
Recommendations

Manpower

Adjust manpower needed to answer phone calls and emails and shift your attention to what really matters

Digitalisation

Display QR codes or provide a device your customers can use to browse articles or get answers



Communication

Improve on communications and website by focusing on popular and trending terms

Inventory / Stocks

Keep up to date with current trends or outbreaks to always have stocks for critical and popular products

Roadmap

Q1 2023

Offer weekly surveys to gather insights on users preferences and needs

Q2 2023

Provides insights from user usages.

- Popular question
- Survey results

Q4 2023

Organize events and workshops with end users and partners

2025

Deploy service to other countries

- Cater to local markets

Thank you!

Questions?

Reach us at
petwhisperers@smartpet.com