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Geek Squad Research Report

NPS Sentiment Analysis Using Natural Language Processing

Introduction

BestBuy utilizes the NPS© survey system to assess overall customer responses in a systematic way. These surveys and their corresponding overall NPS rating of 'Promoter', 'Passive', or 'Detractor' are primary metrics used within the Precinct to evaluate our performance. Developing an understanding of factors driving net NPS ratings could provide direction in an effort guide performance improvement through actionable strategic choices. Since we have a wealth of verbatim data (over 120,000 surveys as of this writing), I felt it would be interesting to apply modern machine learning techniques to the problem. In this report I'll summarize the results of using the Natural Language Toolkit (NLTK) against an extract from a current National survey list.
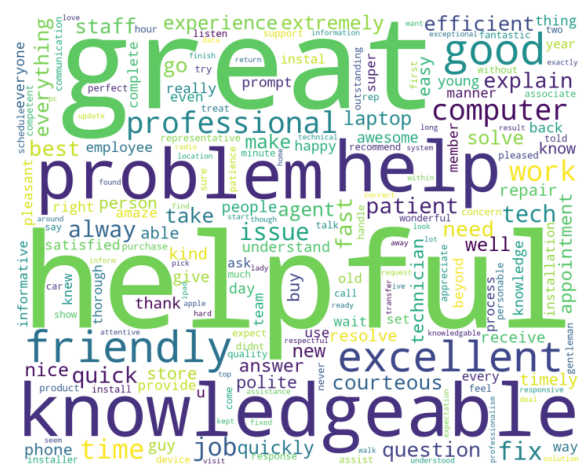
Sentiment Analysis

The term 'Sentiment Analysis' refers to a subset of Artificial Intelligence known as 'Natural Language Processing'. The tools of sentiment analysis have been used to look at customer reviews (Amazon product reviews), movie reviews (imdb reviews) and Twitter tweets, in an effort to 1) glean understanding about factors driving preference and 2) build predictive models that can predict sentiment based on words alone. Given the large body of verbatim comments available via the NPS system I felt it would be appropriate and interesting to perform some analysis on the NPS comments.

The Process

Much of the work required to effectively analyze text databases involves cleaning and pre-processing the data (survey responses). The data are replete with junk - emojis, punctuation marks, single character words and the like. It's important to remove this junk in order to build vocabularies of words that can be analyzed. Fortunately there is a Python library known as NLTK (https://www.nltk.org) that provides many tools to clean text and build corpora (bodies) of words. I have used this library extensively for this

analysis, and this resulted in the creation of Python programs that run on the Precinct MacBook Pro

The overall workflow for data transformation and analysis currently looks like this:

1) Export the national NPS extract from the database to an Excel spreadsheet

2) Utilize my data cleaning program CleanupNPS_national.py to clean the raw comments. This removes garbage text, stop words, punctuation and emojis, resulting in a .csv file suitable for use in downstream data analysis.

3) Utilize my data analysis program NPS_analysis.py to perform word frequency analysis, word cloud[1] creation and bigram and trigram analysis.

Results

In Store Services

One can use word clouds to visualize the frequency distribution of words within a body of text. I've used the word cloud python library to perform this analysis on our promoters, passives and detractors. The resulting word clouds are shown below:

Promoters

Passives

Detractors
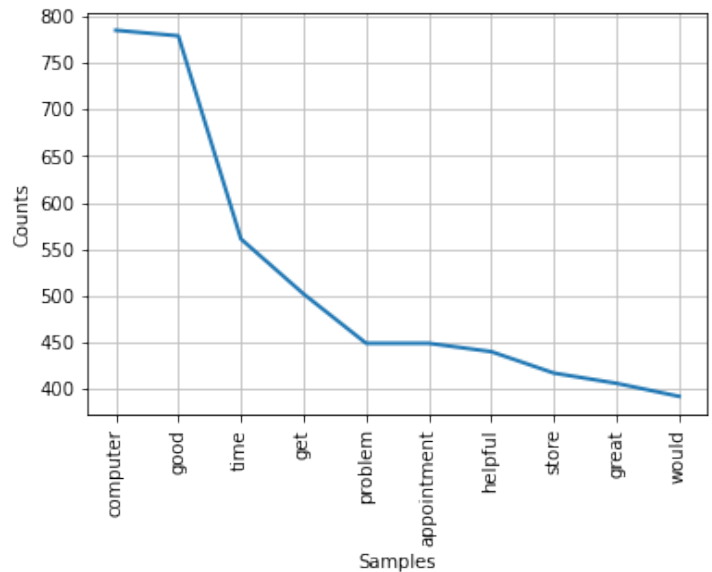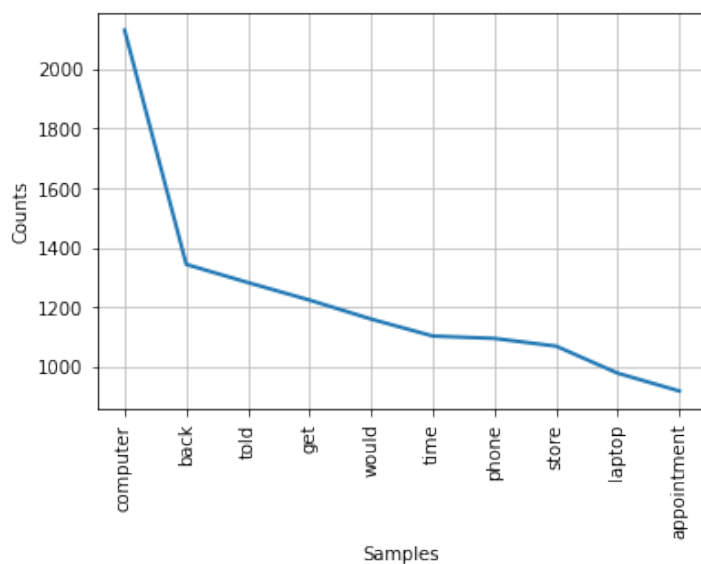
At first blush, the promoter and passive word clouds look remarkably alike, with similar top words. The detractor cloud is very different. We can look at the frequency distribution of words to analyze this a bit more closely. These are shown below.
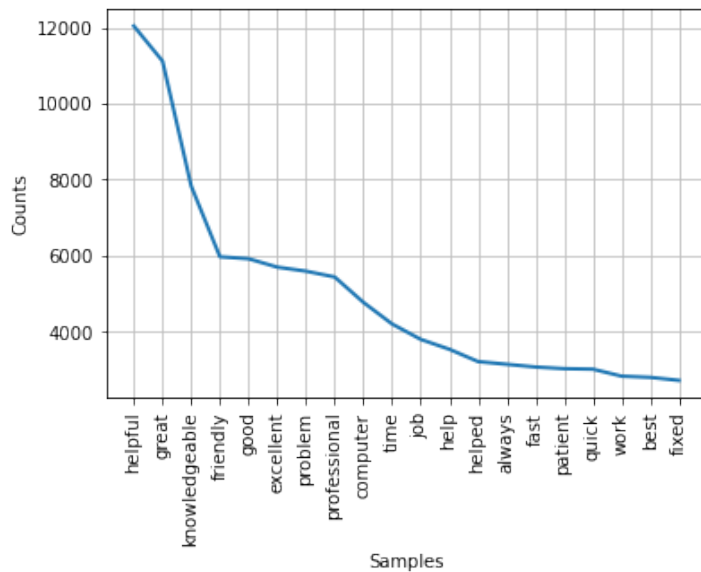
Promoters

Passives

Detractors

It's apparent that there is significant overlap between the individual words in promoter and passive comments, so a single word analysis will be insufficient to see any distinctive patterns between the classes. Fortunately, there is a technique known as 'n-gram analysis' than can calculate the co-occurrence frequencies at word groupings (co-locations). For instance, if we analyze the co-occurrence of two word groupings, that's called *bigram* analysis. If we look at co-occurrence of three word groups it's called

trigram analysis. I implemented bigram and trigram analysis using NLTK's bigram/trigram tools and obtained some interesting results. The top 10 bigrams (word pairs are shown below):

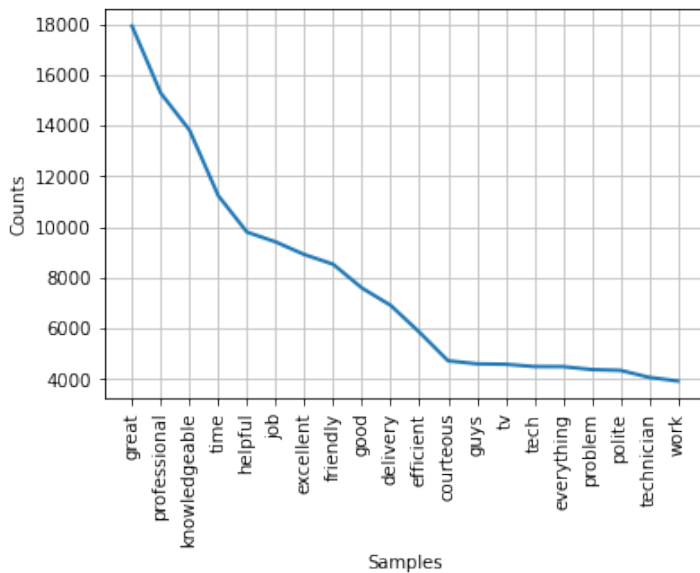| Promoters	Passives	Detractors
answered questions	good job	hard drive
great job	hard drive	next day
went beyond	even though	even though
timely manner	next day	screen protector
extremely helpful	room improvement	total tech
took time	make appointment	new computer
explained everything	new computer	waste time
solved problem	longer expected	fix problem
right away	total tech	sim card
even though	work done	got home

Note the overlap between promoters and passives. When we look at the trigrams we see a clear breakout for detractors:

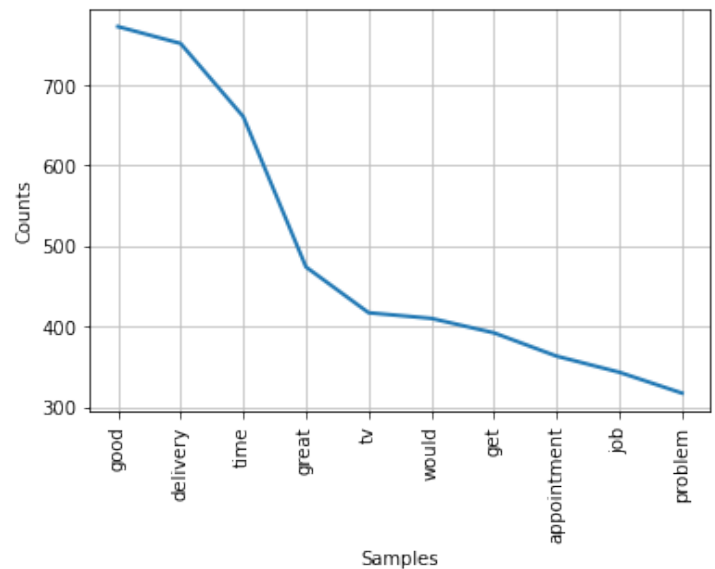| Promoters	Passives	Detractors
questions answered questions	always room improvement	external hard drive
answered questions concerns	took longer expected	new hard drive
patient answered questions	pretty good job	old hard drive
helpful answered questions	experience good job	data hard drive
time answered questions	good job explaining	hard drive back
answered questions asked	good job good	hard drive copied
patiently answered questions	teck good job	hard drive salvaged
answered questions regarding	staff good job	wipe hard drive
answered questions without	good job well	hard drive replaced
answered questions thoroughly	good job took	replacing hard drive

The Detractors' comments point to consistent problems with hard drive service. As of this writing I have not worked backward to retrieve the actual service orders, but that would be a logical next step.
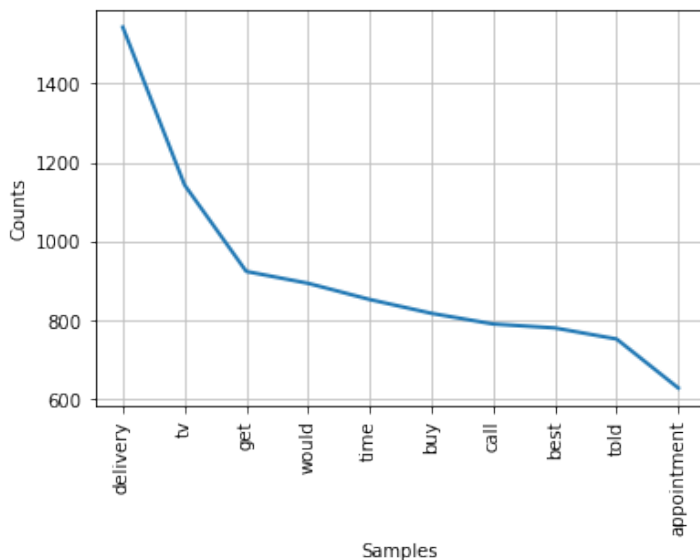
In Home Service Results

If we perform the same analysis on NPS survey responses for In Home (non-third party) services we get the following results:
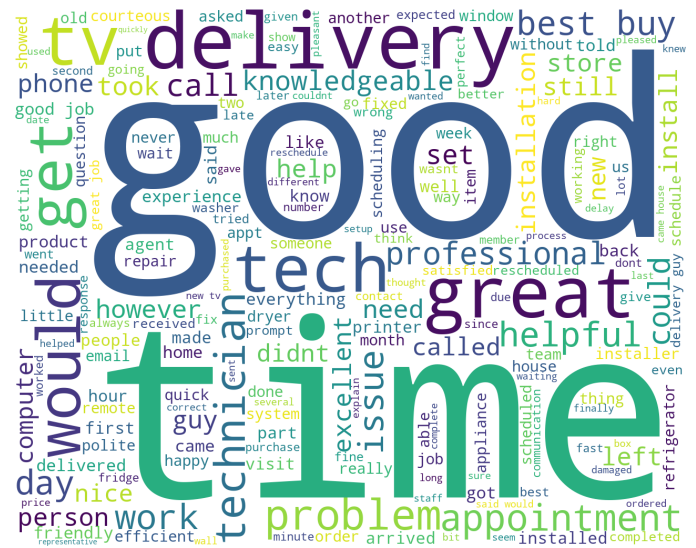

Promoters (USO)

Passives (USO)

Detractors (USO)

Promoters (USO)

Passives (USO)

Detractors (USO)

As before, there isn't a clear breakout visible in the word clouds or word frequencies, but promoters seem to use more positive language. Looking at the bigrams and trigrams proved more informative. See below.

The bigrams and trigrams for In Home Services:

Promoters	Passives	Detractors
answered questions	good job	sound bar
great job	sound bar	washer dryer
made sure	came house	washing machine
went beyond	said would	even though
make sure	even though	next day
explained everything	great job	total tech
fixed problem	went well	fix problem
took time	next day	call back
came house	total tech	haul away
timely manner	delivery date	brand new

The trigrams were:

Promoters	Passives	Detractors
questions answered questions	good job done	sonos sound bar
answered questions answered	good job installing	connect sound bar
answered questions concerns	good job setting	install sound bar
patient answered questions	pretty good job	sound bar working
asked answered questions	guys good job	backwards sound bar
helpful answered questions	good job good	subwoofer sound bar
answered questions patiently	experience good job	lost sound bar
time answered questions	technician good job	sound bar connected
patiently answered questions	good job making	bluray sound bar
answered questions asked	good job figuring	declared sound bar

Summary

I have developed a data flow pipeline that converts raw NPS survey data into a useable format for the application of natural language processing tools. I then used n-gram analysis to analyze the BestBuy National NPS extract, consisting of over 130,000 survey responses. Two-word (bigram) analysis did not yield any clear breakout, but three-word (trigram) analysis indicated that the top ten most frequently used words for detractors fell in the domain of **hard drive issues.** It will be interesting to pull these service orders to look in more detail at this theme. When In Home services were analyzed there was a clear breakout on the trigrams, indicating consistent problems around **sound bars issues.** Both of these observations warrant further analysis.

Next Steps

- Develop code to find and extract the service orders containing the relevant detractor comments based on ngram analysis.

- Attempt to develop predictive models for sentiment using Tensorflow and neural networks.

- Expand the analysis to include additional domains of interest including, deliveries, third party installations, sales, etc.. *The data flow pipeline is capable of working with any of these sources now.*