Leveraging ML for Analysis

Outline

- Classifying Input
- Features, feature extraction
- Training
- Evaluation

Types of ML

- Machine Learning (ML) is a computational approach to classifying or labeling types of input
- Two broad approaches
  - Supervised
    - The learning is based on a training set of data that has been labeled in advance (often by hand)
  - Unsupervised
    - Learning is inferred from unlabeled data

Types of Classification/Labeling

- Binary classification
  - Answers the question does this label/classification apply?
    - Yes or No
    - Assume dichotomous labels (classes)
- Multiple classification
  - Answers the question does this input belong to one of several different categories?

Binary Classifications

- Simple sentiment analysis
  - Is this tweet "happy" or "sad"?
- Generalize to any binary valence
  - Positive to Negative
  - Bright to Dark
  - Introverted to extroverted
- How might this fail?

Sentiment in Twitter
A Query Operator

- REST API
  - Search

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Search all documentation...

Basics

Accounts and users

Tweets

Post, retrieve and engage with Tweets

Get Tweet timelines

Curate a collection of Tweets

Optimize Tweets with Cards

Search Tweets

Filter realtime Tweets

Sample realtime Tweets

Get batch historical Tweets

Rules and filtering

Premium enrichments

Tweet data dictionaries

Tweet compliance

Tweet updates

Search Tweets

Overview Guides API Reference

Guides contents

How to build a standard query

The Search API: Tweets by place

Using standard search

Integrating premium search

Premium search operators

Full-archive search - Metadata and filtering timeline

Standard

Using the standard search endpoint

One way to start testing searches for Tweets, is to first use the twitter.com/search UI, and build an API version from its guidance. There is absolutely not complete parity or completeness, but it's enough to get started. Using the operators below and the search/tweets API, you can iterate on the result by adding more specificity, or negations to get the desired results. As you get a satisfactory result set, the URL loaded in the browser will contain the proper query syntax that can be reused in the API endpoint. Here's an example:

We want to search for Tweets referencing TwitterDev, the word new and the word premium. First, we run the search on twitter.com/search

https://twitter.com/search?q=twitterdev%20new%20premium

Sentiment in Twitter
A Query Operator

- Scroll
  - operators

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Standard search operators

The query can have operators that modify its behavior. Below are examples that illustrate the available operators in standard search:

Operator	Finds Tweets...
watching now	containing both "watching" and "now". This is the default operator.
"happy hour"	containing the exact phrase "happy hour".
love OR hate	containing either "love" or "hate" (or both).
beer -root	containing "beer" but not "root".
#haiku	containing the hashtag "haiku".
from:interior	sent from Twitter account "interior".
list:NASA/astronauts-in-space-now	sent from a Twitter account in the NASA list astronauts-in-space-now
to:NASA	a Tweet authored in reply to Twitter account "NASA".

Sentiment in Twitter
A Query Operator

- Scroll
  - operators

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Standard search operators

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puppy filter:images	containing "puppy" and links identified as photos, including third parties such as Instagram.
puppy filter:twimg	containing "puppy" and a pic.twitter.com link representing one or more photos.
hilarious filter:links	containing "hilarious" and linking to URL.
puppy url:amazon	containing "puppy" and a URL with the word "amazon" anywhere within it.
superhero since:2015-12-21	containing "superhero" and sent since date "2015-12-21" (year-month-day).
puppy until:2015-12-21	containing "puppy" and sent before the date "2015-12-21".
movie -scary :)	containing "movie", but not "scary", and with a positive attitude.
flight :(	containing "flight" and with a negative attitude.
traffic ?	containing "traffic" and asking a question.

Please, make sure to URL encode these queries before making the request. There are several online tools to help you to do that, or you can search at twitter.com/search and copy the encoded URL from the browser's address bar. The table below shows some example mappings from search queries to URL encoded queries:

Search query URL encoded query

Demo

- Try out Twitter Sentiment operators
- How could we try this?

Lexicon Based Analysis

- Twitter sentiment is an example of 'lexicon' based sentiment analysis
  - The lexicon appears to be limited to a few emoticons:
    - :) :-) :(:-(... maybe a few others (hard to tell)
- Could this be improved with a better lexicon?
  - What words would you use?

Lexicon Based Analysis

- Positive words in our lexicon (dictionary)
  - good great awesome outstanding excellent
- Negative words in our lexicon
  - horrible terrible crappy awful
- How would we use a lexicon to analyze tweets?

Lexicon Based Analysis

- How could we improve a lexicon approach?
  - Increase the lexicon?

- Do all words carry the same weight (postive, negative)

Word 1	< or > or =	Word 2
awesome	?	great
better	?	best
angry	?	mad
bonkers	?	great

VADER

- Valence Aware Dictionary and sEntiment Reasoner
  - A lexicon based approach (large dictionary of words)
  - All words in the lexicon are scored
  - Parse text, look up each token in the dictionary aggregate score
- Let's look at how this can work

VADER Demo

- explore_vader.py

General Classification Problems

- Suppose you wanted to classify data using some other categories?
- How would you build a classifier?

Process for Creating a Classifier

- Collect Data
- Create a sub-sample
- Pick one (or several) classification algorithms to try
- Select key features
- Score the sub-sample, positive/negative examples
- Train Classifier
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- Apply Classifier

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Exercise

- Write a program to dump some tweets as CSV
- Output:

  <blank column>,<tweet_id>,<tweet_text>

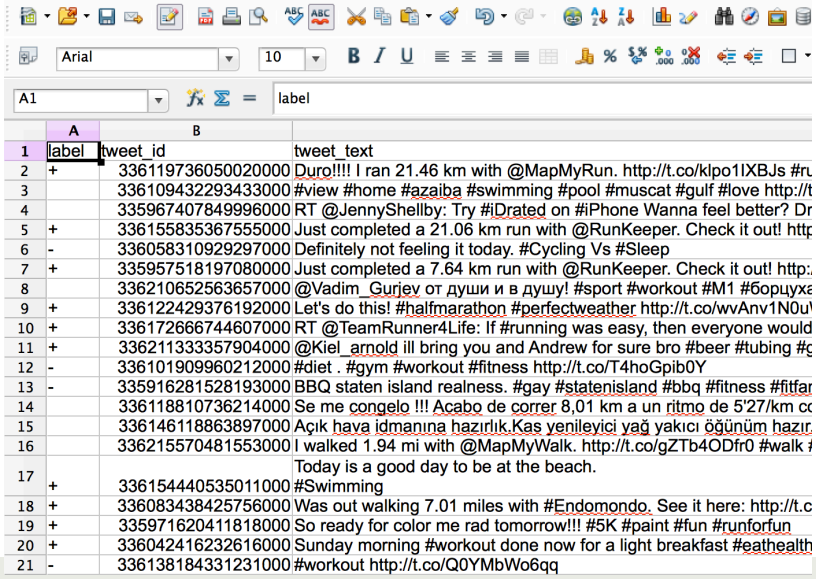
```
,331156160898011136,"I feel so good after running 4.5 miles :D just burnt
like 400 calories :D #exercise #fat #gotta #loose #weight"
```

Samples to Explore

- In hcde user module, ml directory
  - Classification.py – a basic object
  - ClassifyTweet.py – a subclass of Classification
- Sample code
  - explore_feature_selection.py
  - explore_classification.py

Labeled CSV Tweet data

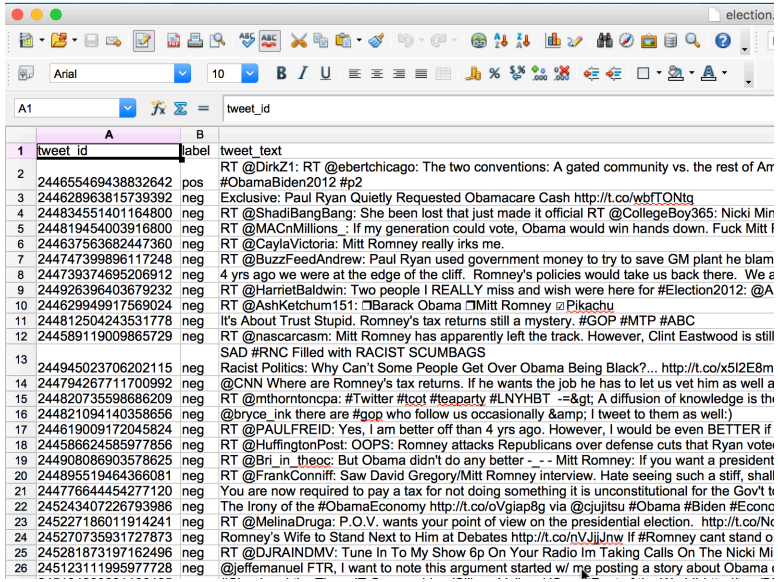
- fitness_label_data1.csv
  - Dump – based on simple_sample.py (using the file output option)
  - Labeled – positive and negative labeling
  - Must have
    - ‘label’
    - ‘tweet_text’



	A	B	
1	label	tweet_id	tweet_text
2	+	336119736050020000	Duro!!!! I ran 21.46 km with @MapMyRun. http://t.co/klpo1IXBJs #ru
3		336109432293433000	#view #home #azaiba #swimming #pool #muscat #gulf #love http://t
4		335967407849996000	RT @JennyShellby: Try #iDrated on #iPhone Wanna feel better? Dr
5	+	336155835367555000	Just completed a 21.06 km run with @RunKeeper. Check it out! http
6	-	336058310929297000	Definitely not feeling it today. #Cycling Vs #Sleep
7	+	335957518197080000	Just completed a 7.64 km run with @RunKeeper. Check it out! http:
8		336210652563657000	@Vadim_Gurjev от души и в душу! #sport #workout #M1 #борцуха
9	+	336122429376192000	Let's do this! #halfmarathon #perfectweather http://t.co/wvAnv1N0u
10	+	336172666744607000	RT @TeamRunner4Life: If #running was easy, then everyone would
11	+	336211333357904000	@Kiel_arnold ill bring you and Andrew for sure bro #beer #tubing #g
12	-	336101909960212000	#diet . #gym #workout #fitness http://t.co/T4hoGpib0Y
13	-	335916281528193000	BBQ staten island realness. #gay #statenisland #bbq #fitness #fitfar
14		336118810736214000	Se me congelo !!! Acabo de correr 8,01 km a un ritmo de 5'27/km co
15		336146118863897000	Açık hava idmanına hazırlık.Kas yenileyici yağ yakıcı öğünüm hazır.
16		336215570481553000	I walked 1.94 mi with @MapMyWalk. http://t.co/gZTb4ODfr0 #walk #
17	+	336154440535011000	Today is a good day to be at the beach. #Swimming
18	+	336083438425756000	Was out walking 7.01 miles with #Endomondo. See it here: http://t.c
19	+	335971620411818000	So ready for color me rad tomorrow!!! #5K #paint #fun #runforfun
20	+	336042416232616000	Sunday morning #workout done now for a light breakfast #eathealth
21	-	336138184331231000	#workout http://t.co/Q0YMbWo6qq

Labeled CSV Tweet data

- Two samples for the fitness data
  - fitness_label_data1.csv
  - fitness_label_data2.csv



	A	B	
1	tweet_id	label	tweet_text
2	244655469438832642	pos	RT @DirkZ1: RT @ebertchicago: The two conventions: A gated community vs. the rest of Am #ObamaBiden2012 #p2
3	244628963815739392	neg	Exclusive: Paul Ryan Quietly Requested Obamacare Cash http://t.co/wbfTONtq
4	244834551401164800	neg	RT @ShadiBangBang: She been lost that just made it official RT @CollegeBoy365: Nicki Min
5	244819454003916800	neg	RT @MACnMillions_: If my generation could vote, Obama would win hands down. Fuck Mitt
6	244637563682447360	neg	RT @CaylaVictoria: Mitt Romney really irks me.
7	244747399896117248	neg	RT @BuzzFeedAndrew: Paul Ryan used government money to try to save GM plant he blam
8	244739374695206912	neg	4 yrs ago we were at the edge of the cliff. Romney's policies would take us back there. We a
9	244926396403679232	neg	RT @HarrietBaldwin: Two people I REALLY miss and wish were here for #Election2012: @A
10	244629949917569024	neg	RT @AshKetchum151: ❒Barack Obama ❒Mitt Romney ☑Pikachu
11	244812504243531778	neg	It's About Trust Stupid. Romney's tax returns still a mystery. #GOP #MTP #ABC
12	244589119009865729	neg	RT @nascarcasm: Mitt Romney has apparently left the track. However, Clint Eastwood is still
13	244945023706202115	neg	SAD #RNC Filled with RACIST SCUMBAGS Racist Politics: Why Can't Some People Get Over Obama Being Black?... http://t.co/x5I2E8m
14	244794267711700992	neg	@CNN Where are Romney's tax returns. If he wants the job he has to let us vet him as well a
15	244820735598686209	neg	RT @mthorntoncpa: #Twitter #tcot #teaparty #LNYHBT -=> A diffusion of knowledge is th
16	244821094140358656	neg	@bryce_ink there are #gop who follow us occasionally & I tweet to them as well:)
17	244619009172045824	neg	RT @PAULFREID: Yes, I am better off than 4 yrs ago. However, I would be even BETTER if
18	244586624585977856	neg	RT @HuffingtonPost: OOPS: Romney attacks Republicans over defense cuts that Ryan vote
19	244908086903578625	neg	RT @Bri_in_theoc: But Obama didn't do any better -_- - Mitt Romney: If you want a president
20	244895519464366081	neg	RT @FrankConniff: Saw David Gregory/Mitt Romney interview. Hate seeing such a stiff, shall
21	244776644454277120	neg	You are now required to pay a tax for not doing something it is unconstitutional for the Gov't t
22	245243407226793986	neg	The Irony of the #ObamaEconomy http://t.co/oVgiap8g via @cjujitsu #Obama #Biden #Econo
23	245227186011914241	neg	RT @MelinaDruga: P.O.V. wants your point of view on the presidential election. http://t.co/No
24	245270735931727873	neg	Romney's Wife to Stand Next to Him at Debates http://t.co/nVJjJnw If #Romney cant stand o
25	245281873197162496	neg	RT @DJRAINDMV: Tune In To My Show 6p On Your Radio Im Taking Calls On The Nicki Mi
26	245123111995977728	neg	@jeffemanuel FTR, I want to note this argument started w/ me posting a story about Obama

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- Collect Data
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Feature Selection

- What are the 'features' of tweets?
- How could you decide which features are important?

Demo Feature Selection

Demo Classification

Interpreting Top Features

```
Most Informative Features
  #Swimming = True        negati : positi =      4.7 : 1.0
  #gym = True             negati : positi =      4.7 : 1.0
  #fitness = True         negati : positi =      3.9 : 1.0
  #RunKeeper = True       positi : negati =      3.4 : 1.0
  completed = True        positi : negati =      3.2 : 1.0
  today. = True           negati : positi =      2.8 : 1.0
  #Workout = True         negati : positi =      2.8 : 1.0
  bring = True            negati : positi =      2.8 : 1.0
```