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Social Media Analytics

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Social Media Content

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Text Data

- Content
  - Tweets, Posts, Blogs, messages,comments
- Attributes
  - Creator – name, demo graphics, geo
  - Date and time
  - Hashtags, URLs, references
  - Consumers – retweets, likes, shares

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Connections Data

- Following/ followed
- Friends and acquaintances
- Business circles
- Shares / likes
- Attributes of people

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Media Data

- Photos, video, live feeds etc.
- Attributes
- Shares / likes

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Applications for Social Media

Customer Management

- Customer opinions are very important to business
- They today express their sentiments through social media
  - Products
  - Services
  - Customer Experience
- Contact Centers have evolved to include Social Media experience too.
  - Contact unhappy customers to reduce attrition
  - Contact interested customers to sell products

Marketing

- Product launches have expanded from Print / Television media to social media
- Social media helps marketers get instant feedback on their messaging.
- Companies identify key persons interested in their products to reach out further

News Media

- Media today understands public sentiment on events from social media
  - World happenings
  - Elections
  - Sports
- This is possible today in real time
- Entertainment media tracks celebrities through social media

Social Media applications

- Mine social media in real time / historical mode to extract text, connections and media
- Understand sentiments and networks
- Identify key actors/ contacts
- Integrate with other internal applications to create customer 360.

REST APIs

- Almost all Social Media Websites provide REST APIs
- Content is usually JSON
- Authentication and authorization through OAuth
- Developer support and documentation
- Rate limits for free access
- https://apigee.com/console

Challenges with Social Media Analytics

Unstructured Data

- Most social media is text.
- Text may or may not contain relevant information all the time.
- Filtering data depends upon hashtags and references
- Multi-lingual
- Language used contains a lot of non-standard words/phrases

Incomplete & Dirty Data

- All persons/ companies on the social web do not share all the information
- Information is limited by security/privacy constraints.
- APIs have additional security limits on whose and what data they can access.
  - Additional logic required to identify and handle permission issues
- Information available may not confirm to expected formats
  - Names
  - Dates

Rate Limits

- All public APIs have rate limits
  - number of queries
  - size of results
- Developers need to get creative about how to use the available bandwidth in a smart manner
  - Pacing queries
  - Caching and archiving
- Becomes tough during development phase.
  - Use cached / saved data as much as possible
  - Data feed simulators

REST API

REST

- Almost all Social media APIs use REST.
- Representational State Transfer. A method of exchanging information between a client and a server
  - Uniform interface
  - Stateless
  - Client server
  - Cacheable
- Usually over HTTP
- CRUD Operations (Create, Read, Update, Delete) on resources
- GET, POST, DELETE, PUT as methods
- Resources and actions identified using URIs

Sample REST Query

- Request

```
GET https://api.linkedin.com/v1/people/~?oauth2_access_token=AQVPzkNJsvg1zcsiGGL-
b7cCoXgZtBAVPcjBwTlBWxjh_5jOYf_V6LuLxrEkUd0fzasfta8tStSoP5vXPB5GoDywO2BVsg-
clXCB2DkGw9yFZDW3zsK4ZTLKHzL2_T2lSl_CUwoBirI1FllMsEwo-
qlGX6pgNvAn2lJunui8RMUsltkTrDk&format=json HTTP/1.1
```

- Response

```
{
  "firstName": "Kumaran",
  "headline": "Data Science / Analytics Leader",
  "id": "xJJOxZaSwN",
  "lastName": "Ponnambalam",
  "siteStandardProfileRequest": {
    "url":
"https://www.linkedin.com/profile/view?id=AAoAAADdSlkBecL8JAojUfnbkvm8jGdbj1raIt
I&authType=name&authToken=Zs7C&trk=api*a3227641*s3301901*"
  }
}
```

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OAuth

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Overview

- Open Authorization protocol
- Enables applications to obtain authorized access to other's data
- No need to share passwords with applications /developers
- Supports web, desktop and mobile applications
- Almost all social websites and cloud services use Oauth
  - Social media like Twitter, Facebook, LinkedIn, Google, Github
  - Cloud apps. like Salesforce, Amazon, Paypal

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Roles

- Resource Owner
  - Who owns the data (e.g: twitter user)
  - Provides authorization for applications to access data
- Authorization Server
  - Manages authentication and authorization (e.g. facebook)
- Resource Server
  - Provides data (e.g. facebook)
  - Can be different from authorization Server
- Client
  - Application who needs data
  - Get authorization keys from the owner, authenticates through authorization server and access data from resource server.

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General workflow

- Owner creates an "application" on the Authorization Server
- Authorization server generates access keys
  - Consumer Key/ Consumer Secret /OAuthToken/ OAuthSecret
  - API Key
- Owner provides access keys to the client developer
- Developer builds the client to use access keys
- Client authenticates/authorizes with authorization server
- Authorization server issues access token with set timeouts
- Client uses access token to access resources on resource server
- Resource server validates access token with authorization server and provides data to the client.

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Real time streaming

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Linking Data

Linking Data

- Social Media data needs to be linked with other data to obtain between insights
  - Customer databases
  - Marketing databases
  - Other social media
- Requires linking different contact handles
  - Twitter handle, Facebook ID, email ID, phone number
- Person API helps provide cross-linking

Twitter Data Mining

Twitter Data

What is Twitter?

- A micro-blogging site that allows users to publish their events, comments, likes and dislikes
- 140 character tweets
- Ability to see other's tweets without permissions
- Shares and retweets
- Follow interesting persons and entities
- Asymmetric relationships – you don't need permissions to follow someone

Twitter Data

- Users and timelines
- Tweets
  - 140 characters
  - User mentions (@)
  - Hashtags
  - URLs
  - Media
  - retweets
- Timelines
- Friends and followers
- Direct messages
- Lists and favorites

Twitter API

Twitter REST API

- https://dev.twitter.com/rest/public
- REST
- Oauth
- JSON
- Searches
- GET, POST and UPDATES
- Rate Limits

Work Flow

- Create an application at https://apps.twitter.com
- Application settings
- Keys and Access tokens
  - Consumer Key
  - Consumer Secret
  - Access Token
  - Access Token Secret
- Permissions
  - Pretty open
  - Access self and other user's messages and followers

Facebook Data Mining

Facebook Data

What is Facebook?

- An online social network service
- Connects people
- Symmetric relationships
- Share messages and media
- Like / unlike / comment
- Create circles like friends, family and acquaintances

Facebook Data

- Users
- Posts
  - User mentions (@)
  - Hashtags
  - URLs
  - Media
  - Likes, comments and shares
- Timelines
- Friends and groups
- Chat
- Events

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Facebook API

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Facebook Social Graph API

- https://developers.facebook.com/tools/explorer
- REST
- Oauth
- JSON
- Searches
- Privacy
- Rate Limits

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Work Flow

- Create an access token at https://developers.facebook.com/tools/explorer
- Application settings
- Create Access token and Query visually
- Copy Access token and Query to code and build analytics
- Permissions
  - Limited access due to privacy
  - Self can access posts, friends and comments
  - Public access limited by privacy settings.

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Google+ Data

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What is Google+?

- An online social network service
- Connects people
- Symmetric relationships
- Share messages and media
- Plus One, comments
- Create circles like friends, family and acquaintances

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Google+ Data

- People
  - Lined to a google account
  - Attributes
- Activities
  - Posts and shares
  - Plus ones
- Comments
  - Associated with activities and people
- Moments

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Google+ API

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Google+ API

- https://console.developers.google.com/apis/api/plus/overview
- Oauth and simple API key
- JSON
- Searches
- Privacy – pretty open compared to Facebook
- Rate Limits – less strict
- Documentation : https://developers.google.com/+/web/api/rest/

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Work Flow

- Create an application at https://console.developers.google.com/apis
- Enable Google+ API
- Create an API key
- Use the API key in your application

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Introduction to Use Cases

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Use Cases

- Use cases are based mostly on Twitter and Google+ data
  - Privacy and security issue limit who's data we can mine for examples
- Might find it repetitive since the same steps are involved
- Focus on getting data into local data structures.
  - Then regular data mining techniques can be used

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Machine Learning Overview

Overview

- Data contains attributes
- Attributes show relationships (correlation) between entities
- Learning – understanding relationships between entities
- Machine Learning – a computer analyzing the data and learning about relationships
- Machine Learning results in a model built using the data
- Models can be used for grouping and prediction

Data for machine learning

- Machines only understand numbers
- Text Data need to be converted to equivalent numerical representations for ML algorithms to work.
- Number representation
  - (Excellent, Good, Bad can be converted to 1,2,3)
- Boolean variables
  - 3 new Indicator variables called Rating-Excellent, Rating-Good, Rating-Bad with values 0/1
- Document Term matrix

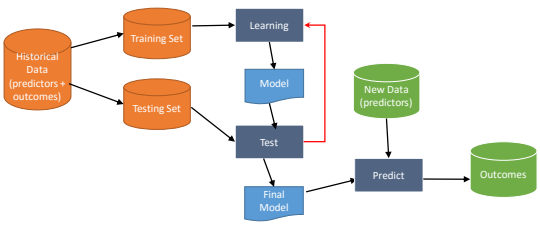
Unsupervised Learning

- Finding hidden structure / similarity / grouping in data
- Observations grouped based on similarity exhibited by entities
- Similarity between entities could be by
  - Distance between values
  - Presence / Absence
- Types
  - Clustering
  - Association Rules Mining
  - Collaborative Filtering

Supervised Learning

- Trying to predict unknown data attributes (outcomes) based on known attributes (predictors) for an entity
- Model built based on training data (past data) where outcomes and predictors are known
- Model used to predict future outcomes
- Types
  - Regression (continuous outcome values)
  - Classification (outcome classes)

Supervised Learning Process



Training and Testing Data

- Historical Data contains both predictors and outcomes
- Split as training and testing data
- Training data is used to build the model
- Testing data is used to test the model
  - Apply model on testing data
  - Predict the outcome
  - Compare the outcome with the actual value
  - Measure accuracy
- Training and Test fit best practices
  - 70-30 split
  - Random selection of records. Should maintain data spread in both datasets

Further studies

- Focus of this course is social media data and how to extract them
- Once extracted and transformed to numerical representations all standard ML techniques can be used
- For additional courses, please take a look at
  - https://www.udemy.com/user/kumaranponnambalam/

Text Pre-Processing

Understanding how ML algorithms work

- ML Algorithms work with
  - numbers (continuous data)
  - classes (discrete/ categorical data)
- ML algorithms don't work with text.
- All textual data need to be converted into numbers or classes
- This is one of the main responsibilities of data pre-processing

Text Cleansing

- Remove punctuation
- Remove white space
- Convert to lower case
- Remove numbers
- Remove stop words
- Stemming
- Remove other commonly used words

TF-IDF Overview

- Text Documents are becoming inputs to ML more and more.
  - News items for classification
  - Email messages for spam detection
  - Text search
- Text need to be converted to equivalent numeric representation before ML can be used
- The most popular technique used is Term Frequency – Inverse Document Frequency (TF-IDF)
- TF-IDF output is table where rows represent documents and columns represent words
- Each cell provides a count / value that indicate the "strength" of the word with respect to the document

TF-IDF formulae

Text Frequency (given a word w1 and Document d1)

= (# of times w1 occurs in d1) / (# of words in d1)

Inverse Document Frequency (given a word w1)

= log e (Total # of docs / Total docs with w1)

TF-IDF = TF * IDF

TF-IDF steps

1. Original documents
   Doc 1 = " This is a sampling of good words"
   Doc 2 = " He said again and again the same word after word"
   Doc 3 = " words can really hurt"

2. After cleansing
   Doc 1 = "sample good word"
   Doc 2 = "again again same word word"
   Doc 3 = " word real hurt"

TF-IDF (contd.)

- Creating the count table

Document	sample	good	word	again	same	real	hurt
Doc 1	1	1	1				
Doc 2			2	2	1		
Doc 3			1			1	1

- Finding Text Frequency

Document	sample	good	word	again	same	real	hurt
Doc 1	.33	.33	.33				
Doc 2			.4	.4	.2		
Doc 3			.33			.33	.33

TF-IDF (contd.)

- Finding Inverse Document Frequency
  - Log e (Total docs / docs with the word)

Document	sample	good	word	again	same	real	hurt
IDF	1.098	1.098	0	1.098	1.098	1.098	1.098

- Finding TF-IDF (TF * IDF)

Document	sample	good	word	again	same	real	hurt
Doc 1	.36	.36	0				
Doc 2			0	.44	.22		
Doc 3			0			.36	.36

Linking Data

Linking Data

- Social media data by itself has limited use
- Linking required with CRM / customer /marketing databases to obtain bigger value
  - Unsatisfied customer – who products he brought? When? Are there any open tickets?
  - Prospective customer – have we reached out to him before?
- Link twitter/ Facebook handles with email / phone number
  - FullContact Person API