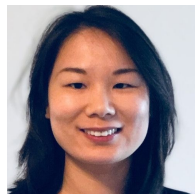
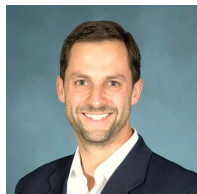


FourthBrain

GLG Project

**A match made in machine learning heaven:
*linking every client request to the best expert***

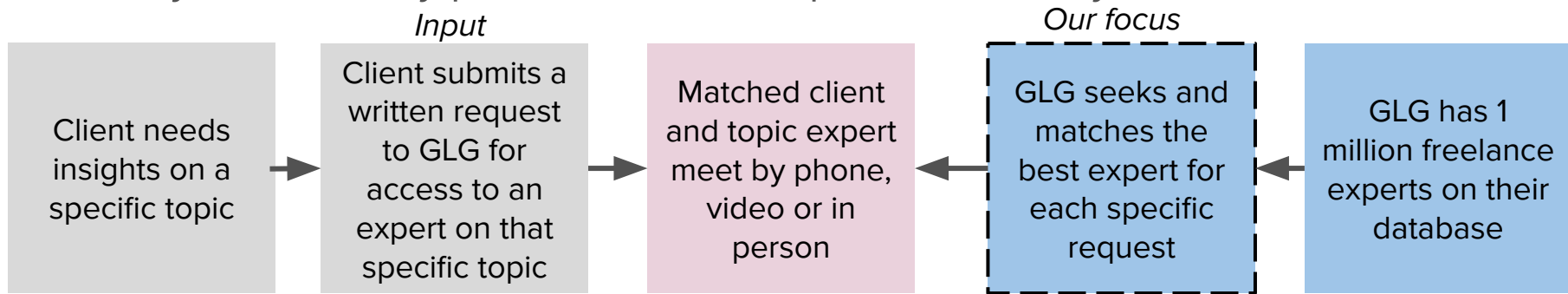
Cris Fortes, Ying Hu, Cody McCormack





Problem (1 min)

GLG's business largely revolves around **matching clients**, requesting insights on a specific topic, **with an expert** on that topic from their large database so that they can meet by phone, video or in person. Visually:



Since GLG receives **100s of these requests** per day, how can they leverage machine learning to **semi-automate the matching process at scale?**



Solution (1 min), *preliminary*

Natural Language Processing (NLP)

1

Named-Entity Recognition (NER)

- Selected libraries: spaCy, The Natural Language Toolkit (NLTK)

2

Clustering

- Topic modeling: latent Dirichlet allocation or LDA (being tested, **promising**)
- K-means clustering (**current results disappointing**; to be tested using better embedding algorithm)

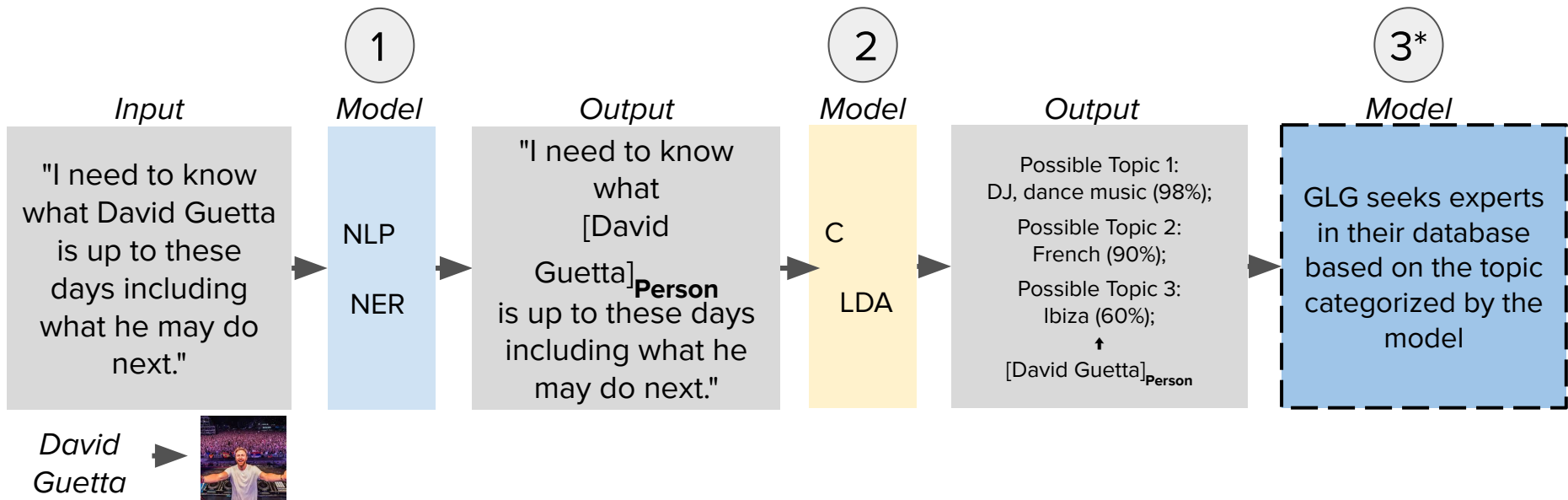
3*

* Step 3 would be to build a recommendation system to suggest the highest matching expert(s) for each request but that is outside the scope of this project



Solution (1 min), *preliminary*

Illustrative and simplified example:



Acronyms: NLP (Natural Language Processing), NER (Named-Entity Recognition), C (Clustering), LDA (latent Dirichlet allocation), DJ (Disc Jockey), GLG (Gerson Lehrman Group). * Step 3 is outside the scope of this project

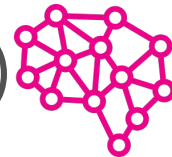
Model status: accomplishments, challenges (1 of 2)



1 Named-Entity Recognition (NER)

	Test 1: spaCY predictions	Test 2: TPOT for AutoML	Test 3: one-hot encoding		Test 4: TF-IDF encoding		Test 5: one-hot encoding with preprocessed data		Test 6: TF-IDF encoding with preprocessed data	
			XGB	Logistic Regression	XGB	Logistic Regression	XGB	Logistic Regression	XGB	Logistic Regression
Accuracy	0.937	Too computa tionally intense for local machine	0.959	0.932	0.935	0.921	0.959	0.932	0.935	0.921
Recall	0.619		0.906	0.761	0.881	0.612	0.906	0.761	0.881	0.612
Precision	0.753		0.755	0.659	0.644	0.638	0.758	0.659	0.644	0.638
F1 Score	0.680		0.824	0.706	0.744	0.625	0.825	0.706	0.744	0.625

Model status: accomplishments, challenges (2 of 2)



2 Clustering

	Model 1: Bag of words + KMeans		Model 2: TF-IDF + KMeans		Model 3: Bag of words + PCA + KMeans		Model 4: Bag of words + PCA + Agglomerative	Model 5: Bag of words + LDA (to be tested further)
n_cluster	2	3	2	3	2	3	Aborted: It took too long to run; after 50 mins, the model was still running. The code is tested on a small portion of the dataset	So far, with topic number = 10, the model seemingly outputs the most sensible list of topics
Silhouette Coefficient	0.28	0.17	0.00814	0.000157	0.28	0.17		
random_states	1, 5, 10, 42	0, 1						
	Silhouette Coefficient decreases as n_cluster increases							



Next steps: starting to develop a web app in Flask

Deployment (*work in progress*)

GLG Match Maker

Team Try It Out Admin

Efficient Matching Via Machine Learning

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. Aenean ultricies mi vitae est. Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, commodo vitae, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. Donec non enim in turpis pulvinar facilisis. Ut felis. Praesent dapibus, neque id cursus faucibus, tortor neque egestas augue, eu vulputate magna eros eu erat. Aliquam erat volutpat. Nam dui mi, tincidunt quis, accumsan porttitor, facilisis luctus, metus ultricies mi vitae est. Mauris placerat eleifend leo.

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas.

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. Aenean ultricies mi vitae est. Mauris placerat eleifend leo.

- Morbi in sem quis dui placerat ornare. Pellentesque odio nisi, euismod in, pharetra a, ultricies in, diam. Sed arcu. Cras consequat.
- Praesent dapibus, neque id cursus faucibus, tortor neque egestas augue, eu vulputate magna eros eu erat. Aliquam erat volutpat. Nam dui mi, tincidunt quis, accumsan porttitor, facilisis luctus, metus.
- Phasellus ultrices nulla quis nibh. Quisque a lectus. Donec consectetuer ligula vulputate sem tristique cursus. Nam nulla quam, gravida non, commodo a, sodales sit amet, nisi.
- Pellentesque fermentum dolor. Aliquam quam lectus, facilisis auctor, ultrices ut, elementum vulputate, nunc.

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. Aenean ultricies mi vitae est. Mauris placerat eleifend leo.

GLG Match Maker

Team Try It Out Admin

Meet the Team

Ying Hu

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. Aenean ultricies mi vitae est. Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, commodo vitae, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. Donec non enim in turpis pulvinar facilisis. Ut felis. Praesent dapibus, neque id cursus faucibus, tortor neque egestas augue, eu vulputate magna eros eu erat. Aliquam erat volutpat. Nam dui mi, tincidunt quis, accumsan porttitor, facilisis luctus, metus

Cris Fortes

My name is Cris Fortes and I'm focused on artificial intelligence, machine learning and deep learning that accelerate business transformation. I see that as a natural evolution of my career as a transformative, results-driven and people-developing leader in strategic sourcing & procurement (Angen, J&J, WPP) and marketing, sales, product management and general management (J&J, Yahoo!, DIRECTV, Siemens).

I've worked, lived and studied in the U.S., Europe and Latin America and speak Portuguese, Spanish and German.

I call beautiful Southern California home.

Cody McCormack

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. Aenean ultricies mi vitae est. Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, commodo vitae, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. Donec non enim in turpis pulvinar facilisis. Ut felis. Praesent dapibus, neque id cursus faucibus, tortor neque egestas augue, eu vulputate magna eros eu erat. Aliquam erat volutpat. Nam dui mi, tincidunt quis, accumsan porttitor, facilisis luctus, metus

© 2022 FourthBrain



Questions:

- Data issue:
 - We don't have GLG's "client request" (input) dataset to test our model.
 - Looking at the clustering results, there is a concern that the **dataset we are using may not be diverse enough** in terms of the topics it involves.
 - Should we use the bigger News 2.0* dataset?
 - if so, do we need to run it on AWS?
- Connections between two parts of the model:
 - How can we use the tagged words from the NER model in the second clustering part?
At the moment, the clustering is done using the entire sentence, with stopwords and punctuation removed.
 - Some sentences don't have tagged words.

* [All the News 2.0 - Components](#): 2.7-million news articles dataset

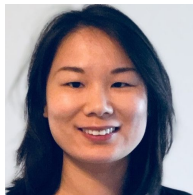
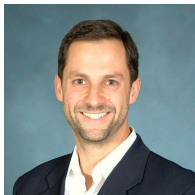


Q&A and Feedback

GLG Project

**A match made in machine learning heaven:
*linking every request to the best expert***

Cris Fortes, Ying Hu, Cody McCormack





Data (1 min)

- Did exploratory data analysis (EDA) on two datasets from Kaggle:
 - [Annotated Corpus for Named Entity Recognition | Kaggle](#)

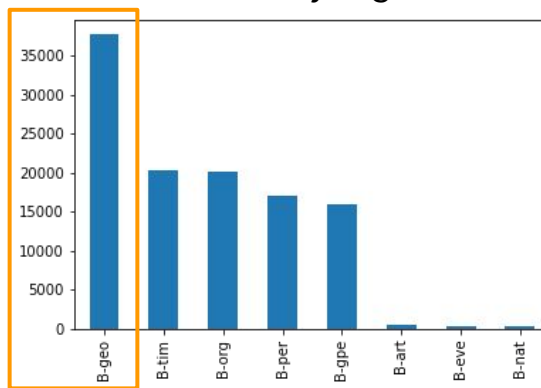
List of entity tags

- geo = Geographical Entity
- org = Organization
- per = Person
- gpe = Geopolitical Entity
- tim = Time indicator
- art = Artifact
- eve = Event
- nat = Natural Phenomenon

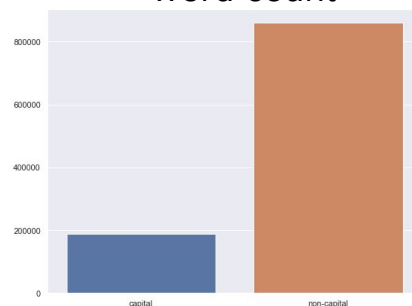
Example of entity tag

Sentence #	Word	POS	Tag
0	Sentence: 1	Thousands	NNS O
1	NaN	of	IN O
2	NaN	demonstrators	NNS O
3	NaN	have	VBP O
4	NaN	marched	VBN O
5	NaN	through	IN O
6	NaN	London	NNP B-geo
7	NaN	to	TO O
8	NaN	protest	VB O
9	NaN	the	DT O

Plot of entity tag count



Capital vs. non-capital word count



- Next step: train our model using this other 2.7-million news articles dataset:
 - [All the News 2.0 - Components](#)

For discussion: use this data to train the model (in light of capstone time constraints?)