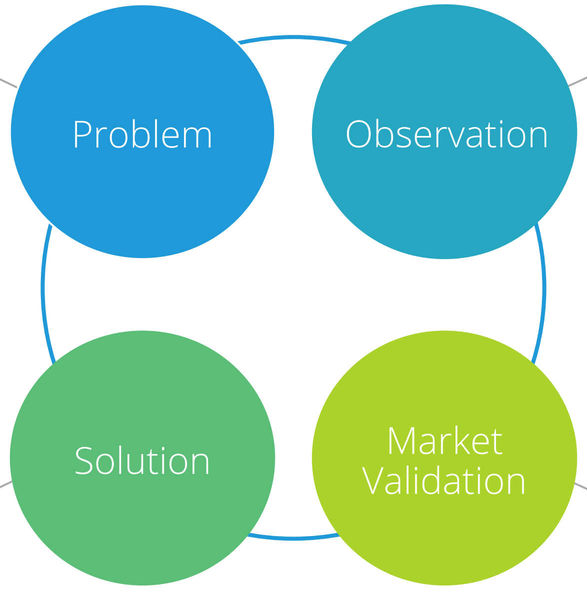
Data-X Spring 2018

Flo

An Email Management System

Ndeye Fatou Diop, Keiko Kamei, Rohan Lageweg,
Ting Chih Lin, Joyce Siu Ying Lo, Kristian Rolland

Flo: An Email Management System



Problem

Course staff receives thousands of emails from students

Observation

Many emails share similarities — common themes include enrollment issues and problems with homework submissions

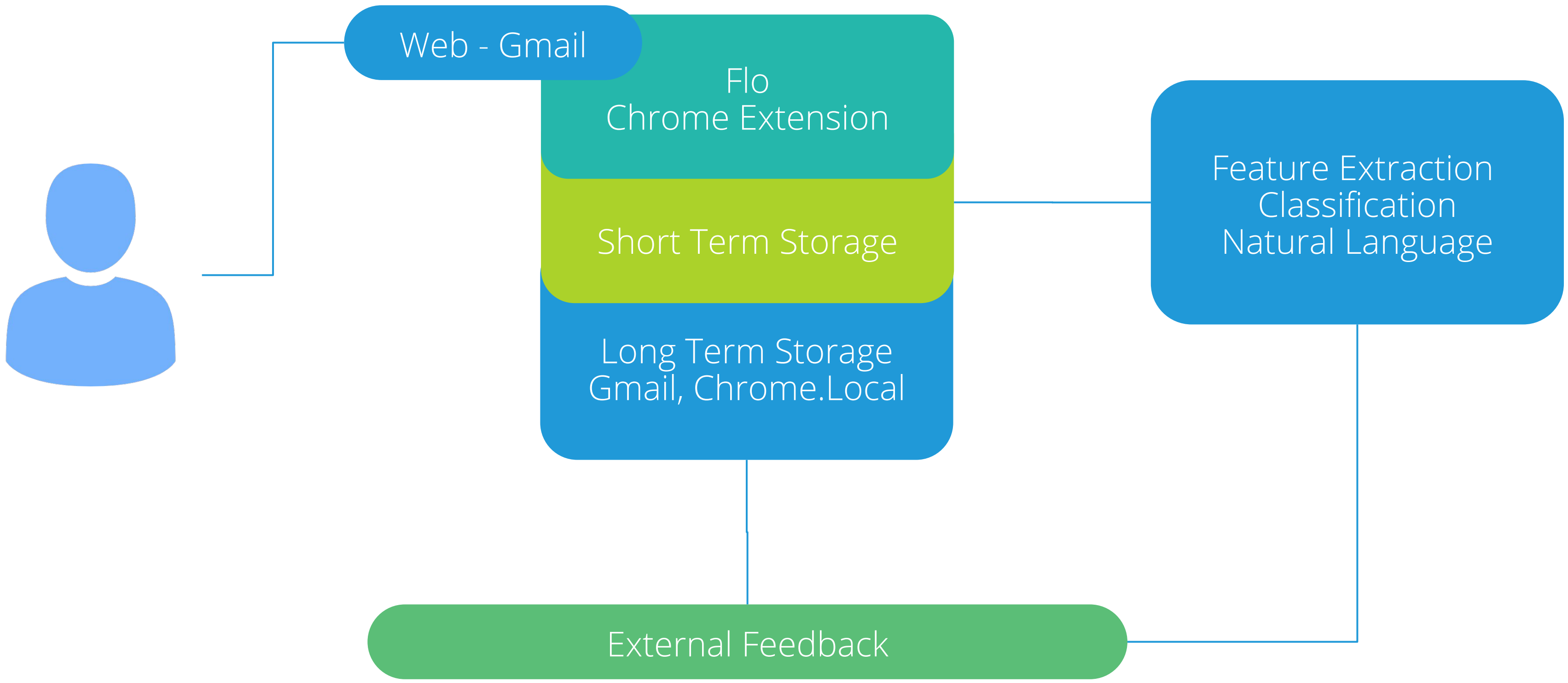
Solution

Email bot that groups emails based on subject matter and offers pre-written responses

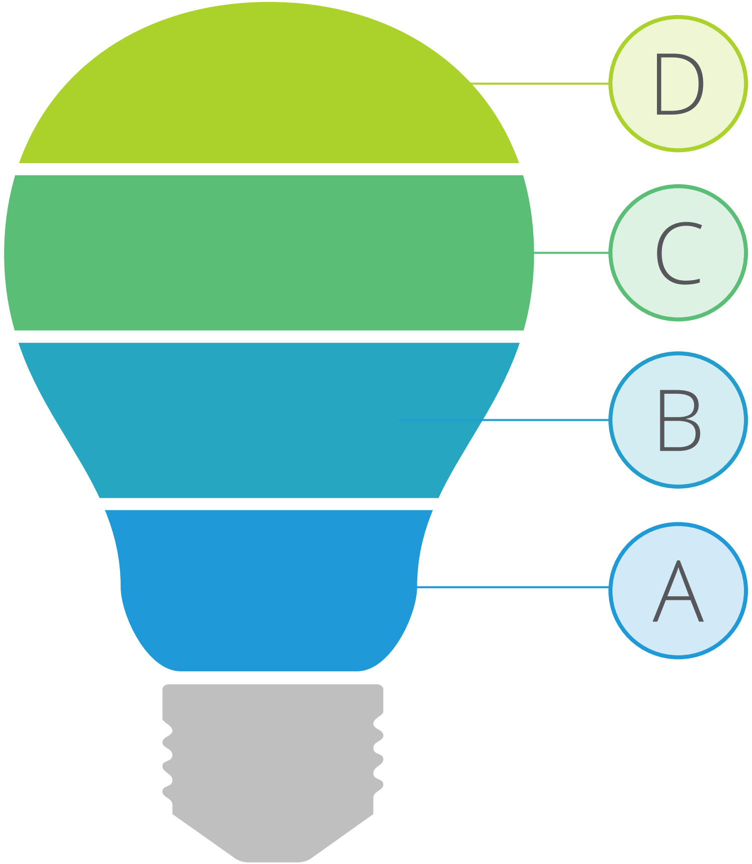
Market Validation

Professors and GSI’s who teach large classes want to reduce time spent responding to emails

Architecture of Solution



Project Outline



Extension + API
Integrate model and output in UI

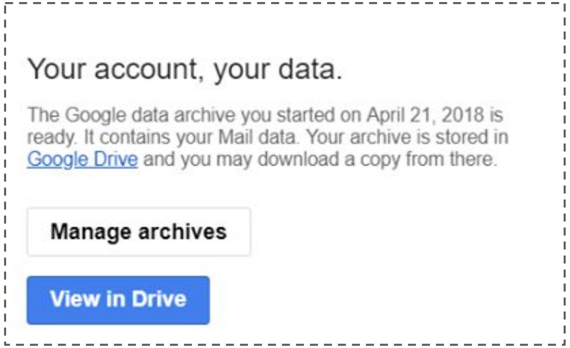
Modeling
Classify emails into categories

Preprocessing
Clean & label data for modeling

Data
Acquire + anonymize data

Data Acquisition

- With permission from course staff, downloaded MBOX file containing roughly 3 months worth of course emails



Your account, your data.

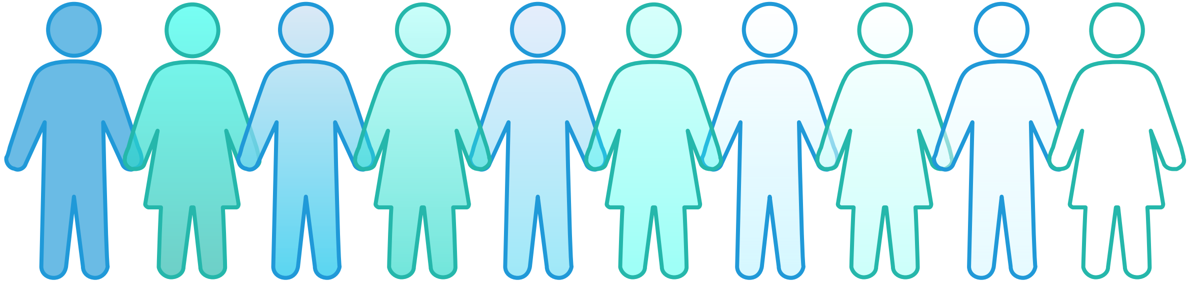
The Google data archive you started on April 21, 2018 is ready. It contains your Mail data. Your archive is stored in Google Drive and you may download a copy from there.

- Dataset:
  - Approximately 350 unique conversations
  - Equates to 1520 total course emails (including replies and forwards)

- Reached out to instructors & teaching staff of other courses but could not obtain data due to student privacy concerns

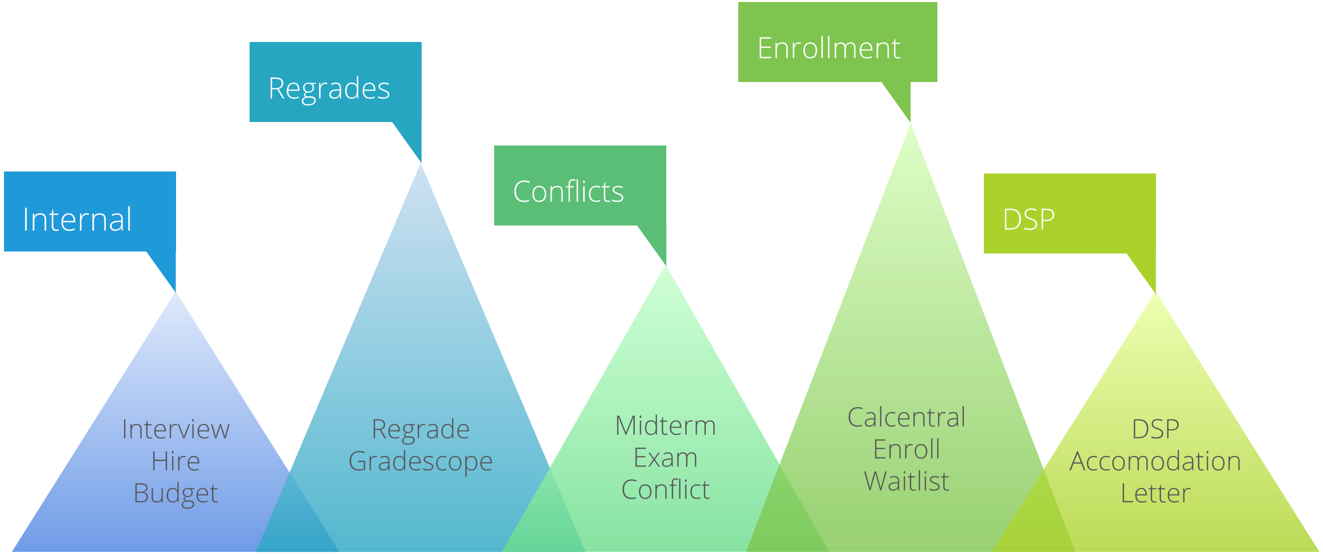
Cleaning & Anonymizing

- Removed any instance of course-identifying words/email ID's
- Filtered out indicators of forwarded messages and unwanted thread attachments via RegEx



Labeling

1. Miscl.
2. Conflicts
3. Attendance
4. Assignments
5. Enrollments
6. Internal
7. DSP
8. Regrades



Our Models

Cos Classifier with LDA topics

LDA topics
⇩
Cosine Similarity

- Validation accuracy: 38.6%
- Pros: No training needed
- Cons: Depends heavily on topic vectors and too much variability

Random Forest

LDA topics
⇩
Random Forest Classifier

- Validation accuracy: 61.4%
- Pros: Easy to train
- Cons: Depends heavily on topic vectors

Cos Classifier with Word2vec

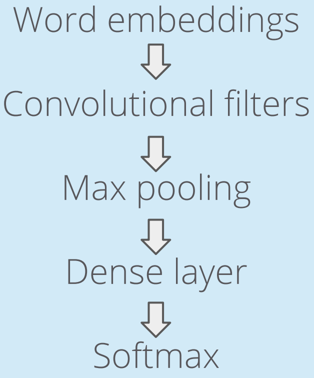
Wor2Vec vectors
⇩
Cosine Similarity

- Validation accuracy: 59.8%
- Pros: No training needed
- Cons: Depends heavily on topic vectors

Baseline accuracy : 37.9%

Our Models

Convolutional Neural Network



Word embeddings

Convolutional filters

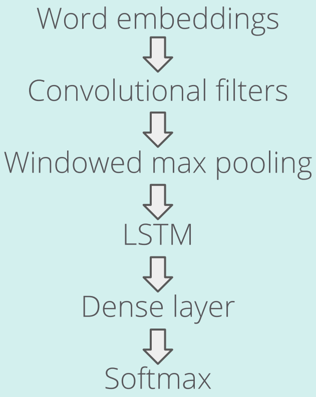
Max pooling

Dense layer

Softmax

- Validation accuracy: 48.8%
- Pros: Easy to train
- Cons: Can't capture long-term dependencies

C-LSTM



Word embeddings

Convolutional filters

Windowed max pooling

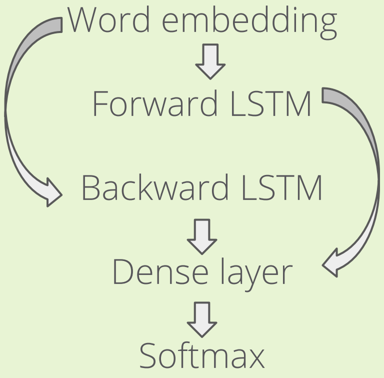
LSTM

Dense layer

Softmax

- Validation accuracy: 51.9%
- Pros: CNN can learn short-term and LSTM can capture long-term dependencies
- Cons: Operates in a single direction

Bidirectional LSTM



Word embedding

Forward LSTM

Backward LSTM

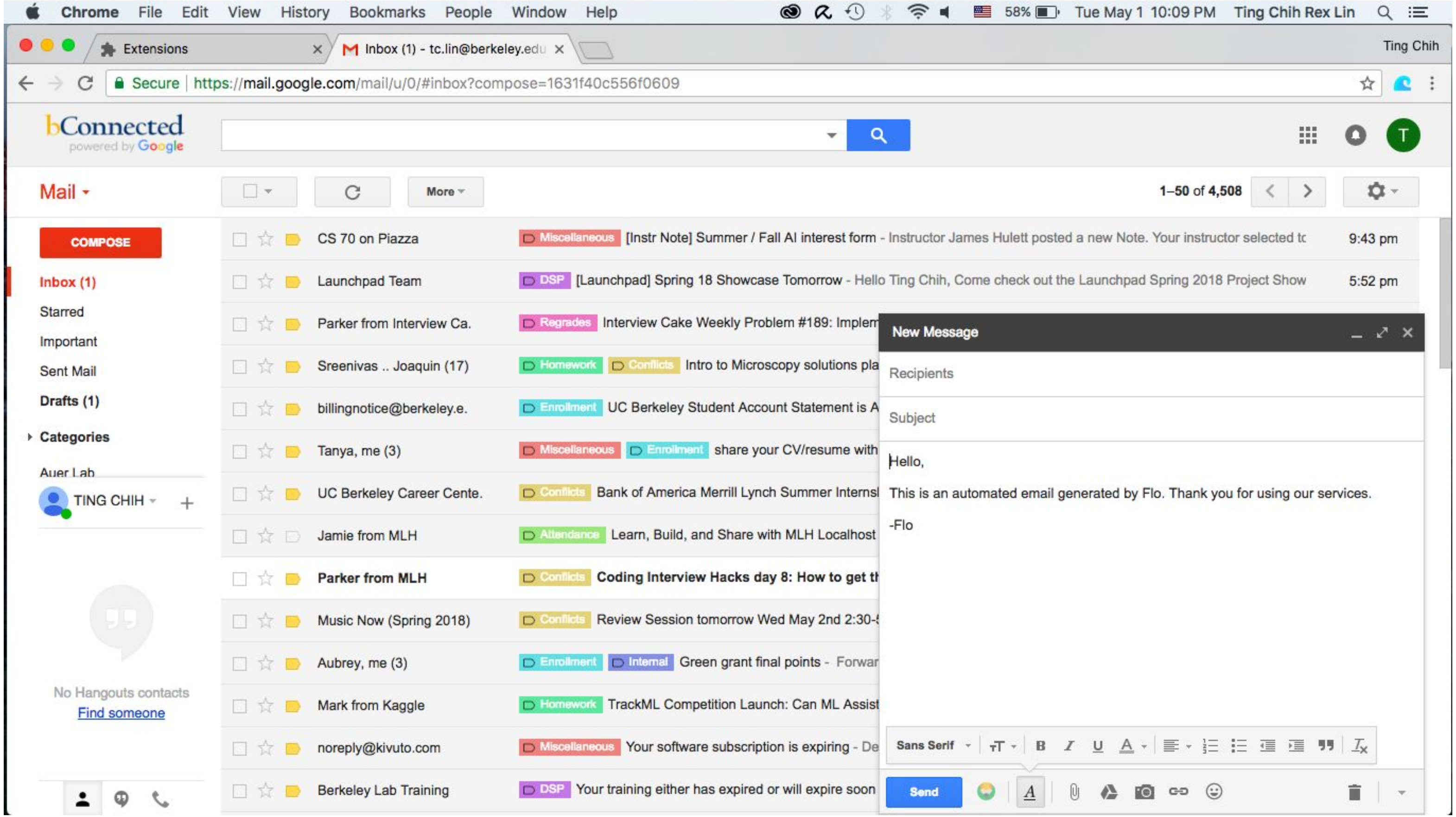
Dense layer

Softmax

- Validation accuracy: 74.1%
- Pros: Can effectively use past and future information
- Cons: Harder to train

Baseline accuracy : 37.9%

Chrome Extension



https://mail.google.com/mail/u/0/#inbox?compose=1631f40c556f0609

CS 70 on Piazza	Miscellaneous [Instr Note] Summer / Fall AI interest form - Instructor James Hulett posted a new Note. Your instructor selected tc	9:43 pm
Launchpad Team	DSP [Launchpad] Spring 18 Showcase Tomorrow - Hello Ting Chih, Come check out the Launchpad Spring 2018 Project Show	5:52 pm
Parker from Interview Ca.	Regrades Interview Cake Weekly Problem #189: Implem	
Sreenivas .. Joaquin (17)	Homework Conflicts Intro to Microscopy solutions pla	
billingnotice@berkeley.e.	Enrollment UC Berkeley Student Account Statement is A	
Tanya, me (3)	Miscellaneous Enrollment share your CV/resume with	
UC Berkeley Career Cente.	Conflicts Bank of America Merrill Lynch Summer Internsl	
Jamie from MLH	Attendance Learn, Build, and Share with MLH Localhost	
Parker from MLH	Conflicts **Coding Interview Hacks day 8: How to get tl**	
Music Now (Spring 2018)	Conflicts Review Session tomorrow Wed May 2nd 2:30-5	
Aubrey, me (3)	Enrollment Internal Green grant final points - Forwar	
Mark from Kaggle	Homework TrackML Competition Launch: Can ML Assist	
noreply@kivuto.com	Miscellaneous Your software subscription is expiring - De	
Berkeley Lab Training	DSP Your training either has expired or will expire soon	

New Message

Recipients

Subject

Hello,

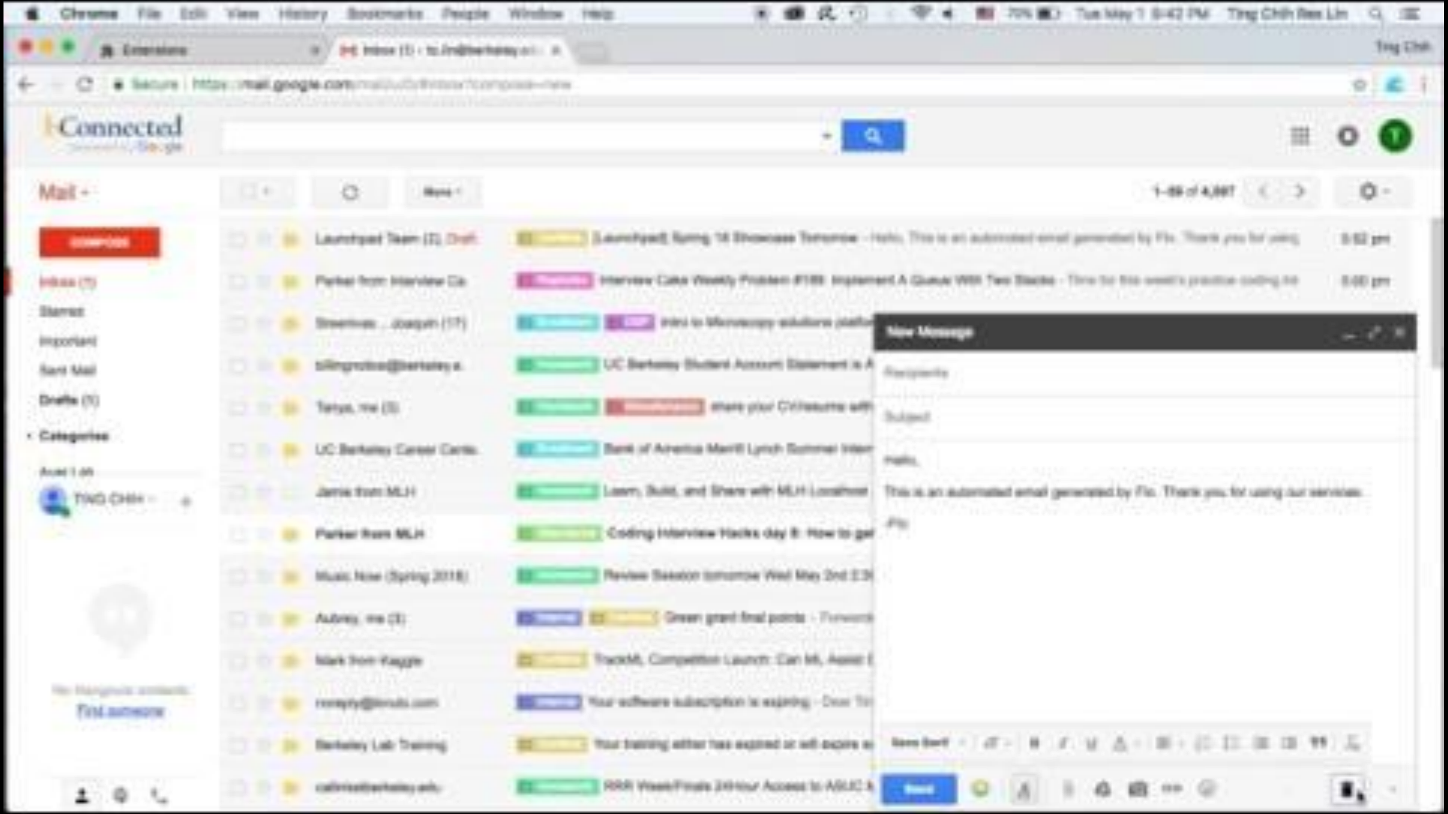
This is an automated email generated by Flo. Thank you for using our services.

-Flo

Server-side Implementation

Google Cloud Platform

Demo



Launchpad Team (2), Draft — [Launchpad] Spring '18 Showcase Tomorrow - Hello, This is an automated email generated by Flo. Thank you for using — 5:52 pm

Parker from Interview Ca. — Interview Cake Weekly Problem #188: Implement A Queue With Two Stacks - Time for this week's practice coding int — 5:00 pm

Sreenivas .. Joaquin (17) — Intro to Microscopy solutions platfo

billingnotice@berkeley.e. — UC Berkeley Student Account Statement is A

Tanya, me (3) — share your CV/resume with

UC Berkeley Career Cente. — Bank of America Merrill Lynch Summer Intern

Jamie from MLH — Learn, Build, and Share with MLH Localhost

Parker from MLH — Coding Interview Hacks day 8: How to get

Music Now (Spring 2018) — Review Session tomorrow Wed May 2nd 2:3

Aubrey, me (3) — Green grant final points - Forward

Mark from Kaggle — TrackML Competition Launch: Can ML Assist

noreply@linode.com — Your software subscription is expiring - Dear Ti

Berkeley Lab Training — Your training either has expired or will expire s

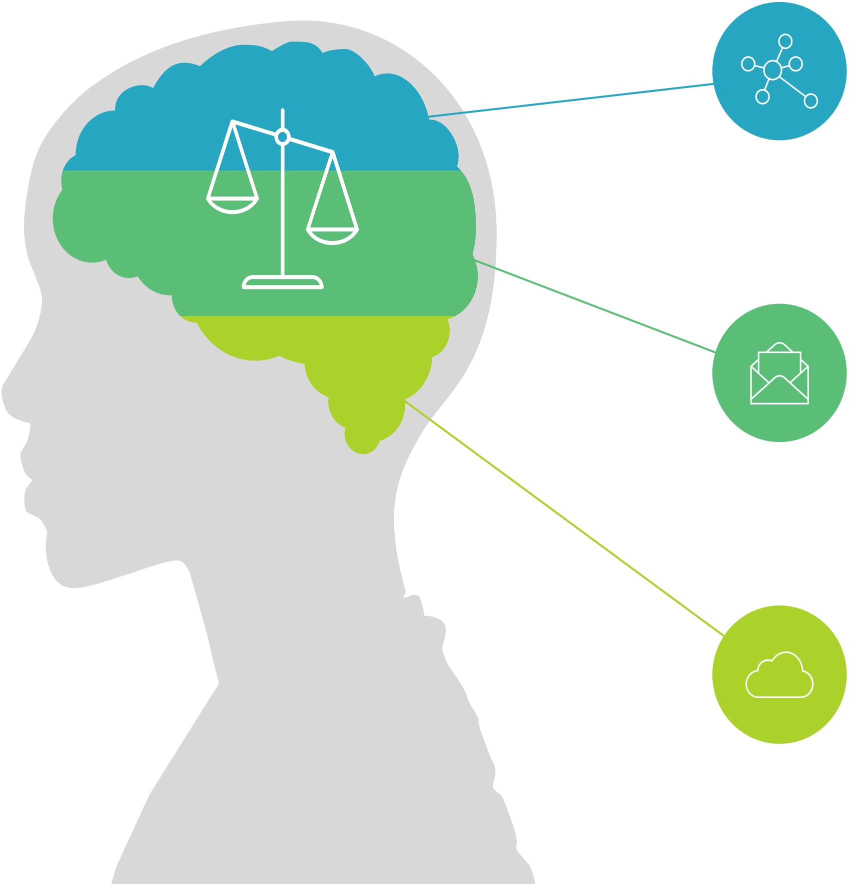
calfmail@berkeley.edu — RRR Week/Finals 24Hour Access to ASUC

Hello,

This is an automated email generated by Flo. Thank you for using our services.

-Flo

Learning Path Summary



Model

- Corpus
  - Google News Vectors
- Word2Vec / Gensim
- Features of Model
  - Time correlation
  - Pre-assign weights

Email Data

- Understand & work with MBOX file type
- Extract relevant data
- Clean and anonymize
- Labeling

Chrome Extension

Looking Forward: Project Release For Summer 2018

1. Data

- More data
- Further exploration for feature extraction
- Labeling variations

2. Models

- Improve categorization model
- Explore different models

3. Extension

- Launch model
- Feedback feature
- Advance Chrome Extension capabilities

4. Response

- Draft responses based on category

Team Flo

Ting-Chih (Rex) Lin
Fourth year MCB.

Keiko Kamei
Hi! I'm a third year studying Applied Math & Data Science and I will be a Team Lead for the Data Modules Program next semester -- Go Bears!

Rohan Lageweg
Hi! I'm a third year studying EECS/MSE and I'm fairly interested in data science. I'm currently a TA for an undisclosed course and Go Bears!

Joyce Lo
Hi, I'm a senior studying statistics and I'm passionate about data science. I'm currently a GSI for DS100 and I'll be working at Facebook after graduation!

Ndeye Fatou Diop
I am a Master of Engineering in IEOR and did my undergrad in France in Applied Math & Computer Science. I plan to work as a Software Engineer after graduation.

Kristian Rolland
Hi, I'm a junior studying Economics at Cal. My other interests include data science, coding, and music producing!

Notable References

- GloVe: Global Vectors for Word Representation

  Stanford Word Vector Paper Published In 2014

  Authors: Jeffrey Pennington, Richard Socher, Christopher D. Manning

- Smart Reply: Automated Response Suggestion For Email

  A Google Paper Published in June 2016

  Authors: Anjuli KAnnan, Karol Kurach, Sujith Ravi, Tobias Kaufmann, Andrew Tomkins, Balint Miklos, Greg Corrado, Laszlo Lukacs Marina Gaenea

- Multi-Task Sequence To Sequence Learning

  A Google Brain Paper Published From March 2016

  Authors: Minh-Thang Luong, Quoc V. Le, Ilya Sutskever, Oriol Vinyals, Lukasz Kaiser