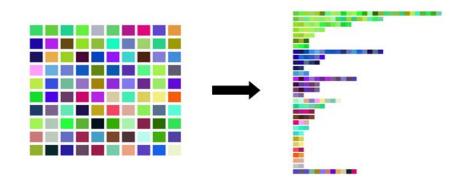
# CASCADE

# **Crowdsourcing Taxonomy Creation**



## Session Overview

- ☐ The Problem
- What is Cascade
- ☐ Initial Prototypes
- Methodology
- Applications



# The Problem

### Nat Friedman, Travelpert

error once by According the trick is BTE. buy it there. Plack the minimum you think you'll need and if you forget something, buy it there. Often I forth and up buying anything, but making this a part of my trip planning helps me relax and pack.

Spite.

Spite and spite of the will let you take your pick.

They're popular among frequent flyers, but I avoid the Bose noise-canceling headphones because they're too big (and the travel case makes there even bigget.) You can get a pair of in-ser noise-isolating headphones that are just an good, half the price, and 1/50th the volume (that's volume in cm<sup>-3</sup>, not db). Slip

them in your pocket and travel light. I use a pair from Shure and they're fine. Luggage with a lifetime guarantee is worth the slight premium in price. Briggs and Riley make a very sturdy bag that's strong enough you can sit on it during a long pre-boarding wait, and with Joppers that ravely break. And when they do - in 5 or 10 years - replacement is free.

If you're tall or otherwise picky about simplane seats, use seatguru.com if to understand the seat layout of your flight. Seatguru will warn you about equipment books under the seat in front of you, cold seats, or seats with a lot of

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Deboard, wait 3 hours, and finally reboard white fighting off the somnelnose.

Obviously depent apply if you don't take sleeping pills to by' (good for you).

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### Jesse Tox, computer scientist

water for Chief Lines, Chief, Alless Chief, Marie Chief, grant Chief, and Chi The MIDI Varyageur (http://www.meinryageur.com/ -/) is a great bag. Tough fatric.
 Its in an airplane overhead bin, and converts from duffle to backpack.

. Cut a credit card with no international transaction or exchange fees. (CapitalOne

others one.)

If you've planning to use an ATM card, make sure that your PNI will work with ATMs where you've going. ATMs in some countries won't handle PRIs that start with 0 or don't have four digits.

The Kindle app on an iPhone or iPod touch lists you carry several travel guides in

. If you find money belts uncomfortable, as I do, see an inside social into you

pants. Any fabric-load store will sail pre-made pockets, and your stitching foeselt need to be pretty. Add a zipper if you like. Take a road trip in the winter Hotels everywhere you go—except for six resofts—will have plenty of vacancies and they'll be charging their lowest rates.

Another road trip (ip; You can use the Priceline smalphine agp to book sooms until 9 PM for the same evening. I sweatly don't know where IT be staying until late attendors, but I've found sooms good deals while still on the road of checked in an hour or two later. You get the freedom of winging it with the reduced attents of foreign where year're hauded incer you arrive.

# 1+ Comments - © Post - Thurst - Jun 4, 2010

### Josh Sprague, alfa

· Eat it before asking what it is.

Learn the language of tacks and bartening. If you can reasonably pronounce the words for directions, your test rates thop in the countries where you happin over states. Also, learning to say "Your moch," "That's too high," "This over and "That over is way more useful to the short-term transfer than "Helin, how are

you?"

Rest focal speens. If you're staying gut for more than a couple weeks, find a local moen is sublet. I lived in a decent house for six months in Thailand for \$30 total over an utilized; It shapen, I occured a traditional bandon on strying more for a month for around \$400 total, in addition to being cheaper than hotels, you tand to experience more of the mall file of the gibbo you're staying.

Also, if you're backpocking, try to make need-local friends at horsels that you can stay with later. German frends made at a hostel in Amsterdam resulted in chopping you're in a German vechad and riding biles on Roman reads; two experiences that wouldn't have happened as a pure tourist.

Find people already drinking. Oraginous locals are the most fun to sit down and have drinks with. If your nationality is a reety, it's easy to some fee drinks. Buy a yourd in ratum and you're the new VIP?

Day a record in extens and by the See New YES.

"We can officiate them a give of you have I, that and being a plan can recall in Yes can find the Yes Can official I was a second of the Yes Can official I was a second of the Yes See New I was a second of the See New I was a second of the Yes See New I was a seco

Have secret stashes for emergencies. After leaving a wallet in a tax before

my flight home. The always kept enough currency for a cab ride/meallythone call stuffed in a rankety of places in luggage, shoes, str.

Keep a copy of your passport online. I've also tost a passport overseas, but having a copy in my Ginsal that I could print from a net calle expedited the process of getting it replaced (4-hour turnaround). There are probably some online security elements to keep in mind with this tip.

Take exeminal, but interesting gifts from your home with you to give to new blends. One of the convol-pleasers five found is the real Vegas playing cards that are sold after cosino use. They're cheep, but special and cards are pretty universal. Organities are too, but depends on your blends.

. Default on the side of action. If someone asks you to join in, you should

# 2+ Comments | Ø Post | Trank Jun 4, 2010

Stationic Wank
Women in the Prestrant, Joseph Lang Agent Text, page He may be the framework more large type flat pump.

If you've training with someone, and you've on a flight with 3 seats across, book the assle and window, leaving the middle seat empty. That seat is much more likely to remain empty, than if you leave the assle or window empty, and if a someone does happen to get placed there, chances are they'll be actained to te witch seats with one

Craig Newmark, customer service rep & founder

When a light's cancelle, get in line, and also call customer service, you don't know which will help out first.

### Andy Cheung, Jason Bourne got nothing on me When Reserving your Ticket

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BUT you can often siphon free wifi by parking yourself near the first class lounces. Those networks are often unprotected.

Update: the password for British Airways' JFK lounge will is "London" (thanks reddt)

As You're Boarding

If you're flying a line-cost carrier like Easyjet, and you're alone, buddy up with another solo traveler - you take the A seat and he takes the C seat. Noone want the middle B seat. More seat space for you leaf

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lists are drawing (at best) to travel with.

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When Reserving your Ticket

### 1000 eGovernment suggestions

50 top product reviews

### 100 employee feedback comments

1000 answers to "Why did you decide to

major in Computer Science?"

### Machines can't analyze it

### People don't have time to analyze it

1.Time consuming

2. Overwhelming

When Reserving your Ticket



# Solution

- When Reserving your Ticket

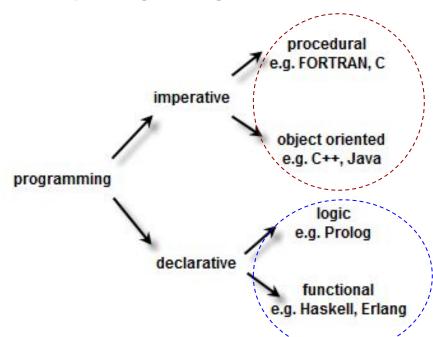
- - traveling (100)
    - air travel tips (49)
      - preparation for flying (38)
        - · comfortable flying (13)
      - airport tips (26)
        - airport shortcuts (17)
      - flight (25)
        - flight comfort (11)
          - seating in airlines (5)
        - flight layovers (2)
      - in flight meals (6)
      - · airport food (4)
      - · best picks for airport and airline food (4)
      - where to sit on long flight (2)
      - membership discounts (2)
    - international phone usage (3)
      - international data plans (2)
    - insider tips (49)
      - · making friends with locals (6)
      - · airport amenities (4)

- **Solution:** Crowdsourced Taxonomies

  - When Reserving your Ticket

# What is a Taxonomy?

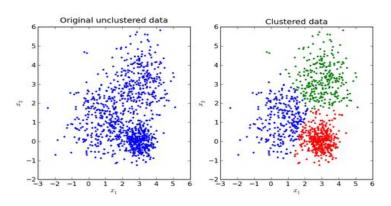
Hierarchical way of organizing the information



# Taxonomies using Al

### Latent Dirichlet Allocation (Topic Modelling),

- Not sure about the right number of topics
- Produce low quality taxonomies.
  - They lack the common sense and language abilities that come naturally to people



# CASCADE: Crowdsourcing Taxonomy Creation

 A novel crowd algorithm that produces a global understanding of large datasets.

 Cascade is an automated workflow that creates a taxonomy from the collective efforts of crowd workers who spend as little as 20 seconds each.

 None of the workers needs to have a global perspective of the data or the taxonomy under construction.

# Concepts and Evaluation

### 3 HITs

Three HIT primitives, simple task interfaces, used as building blocks by Cascade and useful for future crowd algorithms.

### GSI

We introduce Global Structure Inference as a way to combine independently-generated judgments into a cohesive taxonomy.

### **Evaluation**

We evaluate Cascade on three datasets showing that Cascade can perform close to expert level agreement (80-90% of expert performance) for a competitive cost



# Initial Prototypes

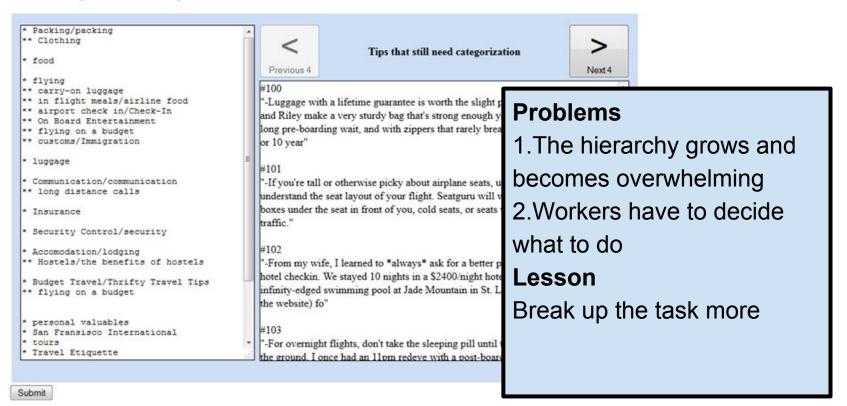
- → Iterative Approach
- → Category Comparison
- → Clustering

# Initial Prototypes

- → Iterative Approach
- → Category Comparison
- → Clustering

# Approach 1: Iterative Improvement

Task: Add Tips to the Hierarchy of Travel Advice

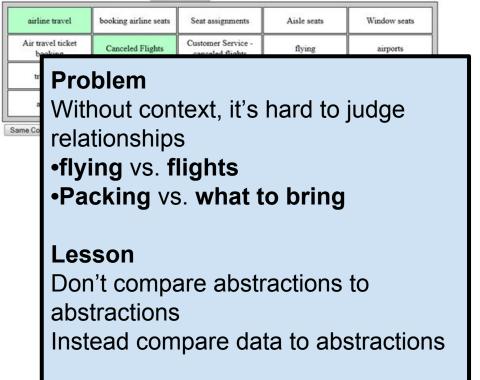


# Initial Prototypes

- → Iterative Approach
- → Category Comparison
- → Clustering

# Approach 2: Category Comparison





# Initial Prototypes

- → Iterative Approach
- → Category Comparison
- → Clustering

# Approach 3: Clustering

### **Help Categorize Travel Tips**

### Instructions:

In the table below there are 10 tips for travelers. We want to organize them into categories. Your job is to:

- Read all 10 tips
- . Think of 3 categories that at least two of these tips belong to. Write them in the colored boxes as column
- . In each column, select at least two tips that fit in that category. The more you can select the better. Br
- . Mark tips that you think are difficult to categorize as "Singleton Tip." If there aren't any, that's okay.
- . Mark tips that don't make sense as "Needs Review." If there aren't any, that's okay.

### Singleton Tip N Travel Tip "-For packing the trick is BIT: buy it there. Pack the minimum you think you'll need and if you forget something, buy it there. Often I don't end up buying anything, but making this a part of my trip planning helps me relax and pack light." "-Passport, wallet, housekey, phone & charger. That's my checklist when I leave the house on the way to a flight. Anything else is a non vital item I figure I can take care of when I get there. You could buy a new phone charger there but this is such an of' "-They're popular among frequent flyers, but I avoid the Bose noise-canceling headphones because they're too big (and the travel case makes them even bigger). You can get a pair of in-ear noise-isolating headphones that are just as good, half the price, an"

### **Problem**

Users often gave categories that fits multiple of the 8 items displayed.

### Lesson

Allow workers to suggest categories that fit one item

# The Right Approach



• Find the tasks people can do.

 Assemble them using complex aggregation techniques.

# Workflow-PHASE I

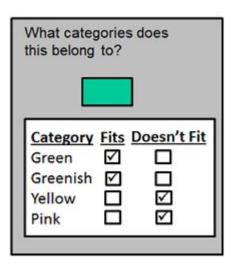
# 3 Human Intelligence Tasks (HIT)



**Generate Labels** 



**Select Best Labels** 



Categorize

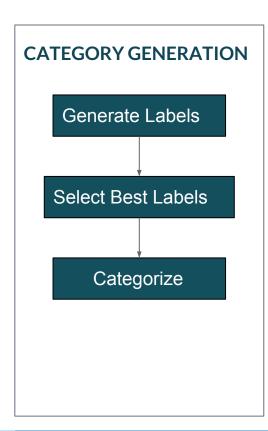
## Workflow: PHASE II

### Global Structure Inference

### 3 Step Process

- 1) Remove Insignificant Categories
- 2) Remove Duplicate Categories
- 3) Create Nested Categories

# **CASCADE** Pipeline





# REPEAT Re-run the

Re-run the process on all the sets

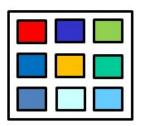


# Cascade Algorithm



# Cascade Algorithm

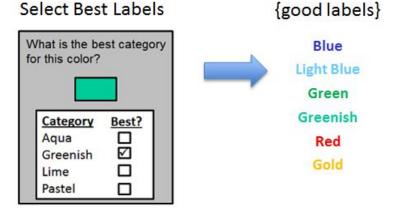




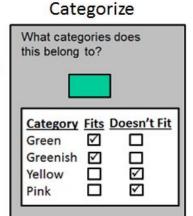
For a subset of items



Generate Labels



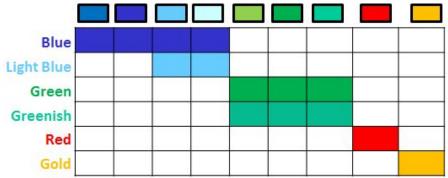
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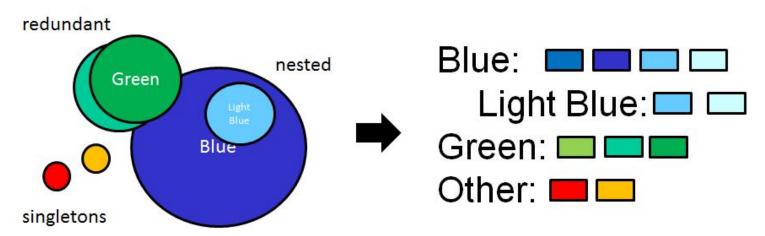




Recursive approach

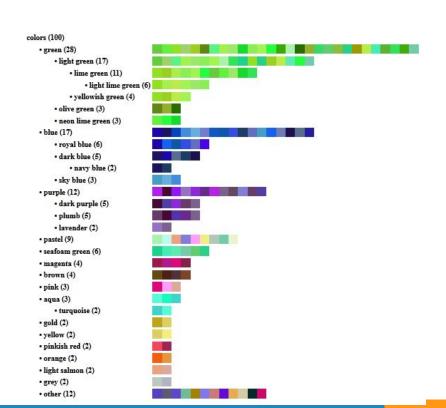
# Aggregate Data into Taxonomy





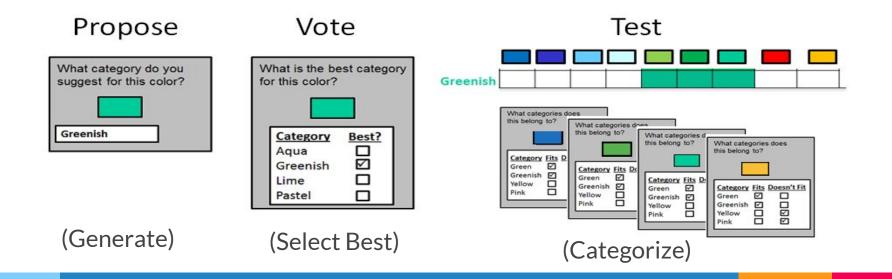
# Cascade Results: 100 Colors





# Propose, Vote, Test

- 1. Let the workers propose categories.
- 2. Vote on categories to weed out bad ones.
- 3. Test the heuristics by verifying it on data.



# **KEY TAKEAWAY**



Propose

(Generate)

Vote

(Select Best)

**Test** 

(Categorize)

# **EVALUATION:** DataSet

### 3 Dataset obtained from Quora.com

Abbreviation	# items	
editWriting	"What are some tips for editing your own writing?"	22
sideProjects	"How can I increase my productivity on my side projects at the end of the day when I'm tired from work?"	67
travel	"What are your best travel hacks?"	100

# **EVALUATION: Metrics**

- 1. Labels Quality
- 2. Hierarchical structure
- 3. Cost and Running time

# **EVALUATION: Metrics**

- 1. Labels Quality
- 2. Hierarchical structure
- 3. Cost and Running time

# **EVALUATION: Accuracy of Labels**

- 1. What fraction of the Cascade taxonomy categories are also named in at least one expert taxonomy?
- 2. What fraction of expert categories are named in another expert taxonomy?

	edit- Writing	side- Projects	travel	Avg.
% of Cascade categories shared by at least one expert	47%	50%	53%	50%
avg % of expert categories shared by at least one other expert	32%	70%	64%	55%

# **EVALUATION: Metrics**

- 1. Labels Quality
- 2. Hierarchical structure
- 3. Cost and Running time

# EVALUATION: Appropriate Hierarchical Structure

- 1. Duplicate categories
- 2. Missing Parent-Child Relationships
- 3. Incorrect Parent-Child Relationships

**Error Rate:** Total Errors

**Total Categories** 

	Edit- Writing	Side Projects	Travel: iteration1	Travel: iteration2
# categories	15	18	7	51
Duplicate Categories	2	2	0	2
Missing Nesting	0	0	0	5
incorrect Nesting	0	3	1	3
Correct Nesting	5	3	1	23
total errors	2	5	1	10
Error rate	13%	27%	14%	20%

# **EVALUATION: Metrics**

- 1. Labels Quality
- 2. Hierarchical structure
- 3. Cost and Running time

# **EVALUATION: Cost and Running Time**

### Cascade versus experts

- The total time spent on all three datasets by the average expert was 6 hours 50 minutes, and the total time spent by MTurk workers was 43 hours 3 minutes.
- Cascade amounted to \$ 369 while average experts costed \$ 171

~Cascade took ~6.5 times longer to complete, and was 2-3 times as expensive

# EVALUATION: Cost and Running Time Contd.

	editWriting	sideProjects	travel
Cascade Time	7 h 56 m	16h 13 m	16h 32m
Avg expert time	1h 23 m	2h 36m	2h 5 m
Cascade Cost	\$35.40	\$109.45	\$224.45
Average Expert Cost	\$34.87	\$65.13	\$71.38

Since the work was replicated 5 times

\$8.39/hour was paid to workers (\$0.05 per HIT and HIT was 21.46 seconds), which is high for MTurk, where \$3-\$4/hour is more typical

# Future work

→ Reduce the cost & Time

Adopt machine learning approaches

# Applying Cascade to REAL WORLD Scenarios

1. CHI 2013

(Top conference for Human-Computer Interaction)

- Organize 430 accepted papers to help session making
- 2. CrowdCamp Hack-a-thon
  - Organize 100 hack-a-thon ideas to help organize teams

# Application: CHI Papers

Patina: Dynamic Heatmaps for Visualizing Application Usage', Effects of Visualization and Note-Taking on Sensemaking and Analysis', Contextifier: Automatic Generation of Messaged Visualizations', Interactive Horizon Graphs: Improving the Compact Visualization of Mu Quantity Estimation in Visualizations of Tagged Text', Motif Simplification: Improving Network Visualization Readability with Evaluation of Alternative Glyph Designs for Time Series Data in a Small Individual User Characteristics and Information Visualization: Connecting "Without the Clutter of Unimportant Words": Descriptive Keyphrases for Direct Space-Time Trajectory Control for Visual Media Editing Your eyes will go out of the face: Adaptation for virtual eyes in video se Swifter: Improved Online Video Scrubbing Direct Manipulation Video Navigation in 3D NoteVideo: Facilitating Navigation of Blackboard-style Lecture Videos Ownership and Control of Point of View in Remote Assistance EyeContext: Recognition of High-level Contextual Cues from Human Vis Your eyes will go out of the face: Adaptation for virtual eyes in video se

- Visualization (19)
  - evaluating infovis (9)
    - text (2)
  - video (6)
  - visualizing time data (5)
  - gaze (4)
    - gaze tracking (3)
  - user requirements (3)
  - color schemes (2)

Still Looking: Investigating Seamless Gaze-supported Selection, Positioning, and Manipulation of Distant Targets Individual User Characteristics and Information Visualization: Connecting the Dots through Eye Tracking Quantity Estimation in Visualizations of Tagged Text

# Two famous papers for Taxonomy creation

# Cascade and Deluge

# Summary

### → What is Cascade

◆ A Crowd-algorithm that generates a taxonomy over a set of independent data items, such as travel items, color blocks etc.

## Methodology

◆ Propose, Vote, Test, Global Structure Inference

## → Applications

Q&A sites (Quora), Online Competitions (CrowdCamp)