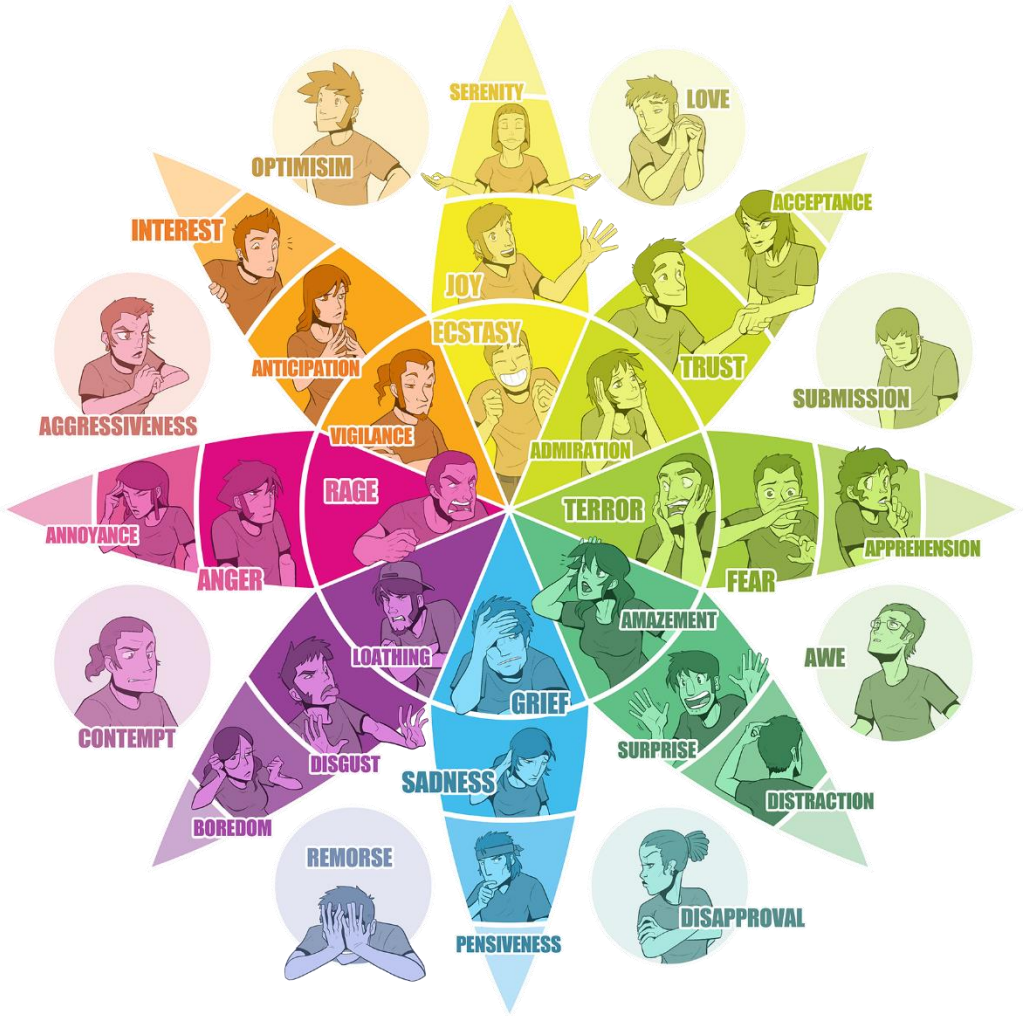
Emotion Maps Based on Geotagged Posts in the Social Media



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My Sad Self, Allen Ginsberg

Sometimes when my eyes are red
I go up on top of the RCA Building
and gaze at my world, Manhattan—
my buildings, streets I've done feats in,
lofts, beds, coldwater flats
on Fifth Ave below which I also bear in mind,
its ant cars, little yellow taxis, men
walking the size of specks of wool—
Panorama of the bridges, sunrise over Brooklyn machine,
sun go down over New Jersey where I was born
& Paterson where I played with ants—
my later loves on **15th Street**,
my greater loves of **Lower East Side**,
my once fabulous amours in the **Bronx**
faraway—
paths crossing in these hidden streets,
my history summed up, my absences
and ecstasies in **Harlem**—
—sun shining down on all I own
in one eyeblink to the horizon
in my last eternity—
matter is water.

My Sad Self, Allen Ginsberg

Sad,
I take the elevator and go
down, pondering,
and walk on the pavements staring into all man's
plateglass, faces,
questioning after who loves,
and stop, bemused
in front of an automobile shopwindow
standing lost in calm thought,
traffic moving up & down **5th Avenue** blocks behind me
waiting for a moment when ...

Time to go home & cook supper & listen to
the romantic war news on the radio
... all movement stops
& I walk in the timeless sadness of existence,
tenderness flowing thru the buildings,
my fingertips touching reality's face,
my own face streaked with tears in the mirror
of some window—at dusk—
where I have no desire—
for bonbons—or to own the dresses or Japanese
lampshades of intellection—

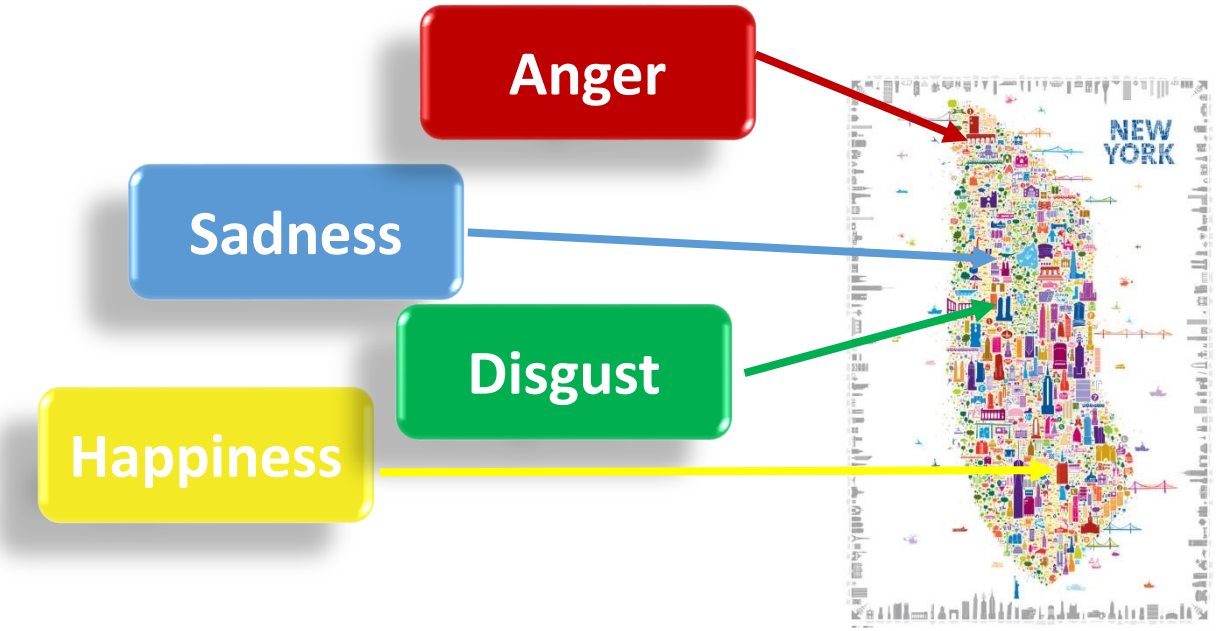
My Sad Self,
Allen Ginsberg

Confused by the spectacle around me,
Man struggling up the street
with packages, newspapers,
ties, beautiful suits
toward his desire
Man, woman, streaming over the pavements
red lights clocking hurried watches &
movements at the curb—

And all these streets leading
so crosswise, honking, lengthily,
by avenues
stalked by high buildings or crusted into slums
thru such halting traffic
screaming cars and engines
so painfully to this
countryside, this graveyard
this stillness
on deathbed or mountain
once seen
never regained or desired
in the mind to come
where all **Manhattan that I've seen** must disappear.

Emotions

- Emotions affect many aspects of people's lives – behavior, interactions between people, health, etc.
- There are often (but not always) interrelationships between emotions and geographic places, e.g., different emotions are associated with
  - Hospital
  - Amusement park
  - Transportation hub
  - Public library
  - School

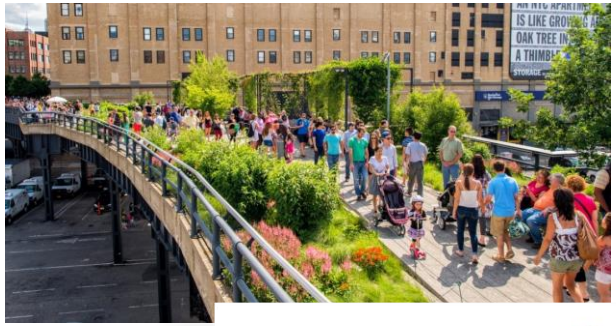


Emotion Map

- A thematic map that depicts how people feel in different places
- Can support the following two types of queries:
  - **Analysis**: given a location, what are the typical emotions in that place?
  - **Geospatial Emotion Retrieval**: given an emotion, what are the places where this emotion is intensely expressed

How does art (e.g., a statue) affect people

Emotion maps may be useful for analyzing or predicting political changes, riots, revolutions and other historical events



Touristic Guide: Help to find places that are romantic, happy, thrilling, inspiring, funny, relaxing, etc.

General Approach

- Analyze big data sets of **social media post**
- Use an **emotion analysis** tool to analyze each post
- Find **interrelationships** between emotions and areas based on the analysis of the posts in the area

Naïve Heat Map

Happiness

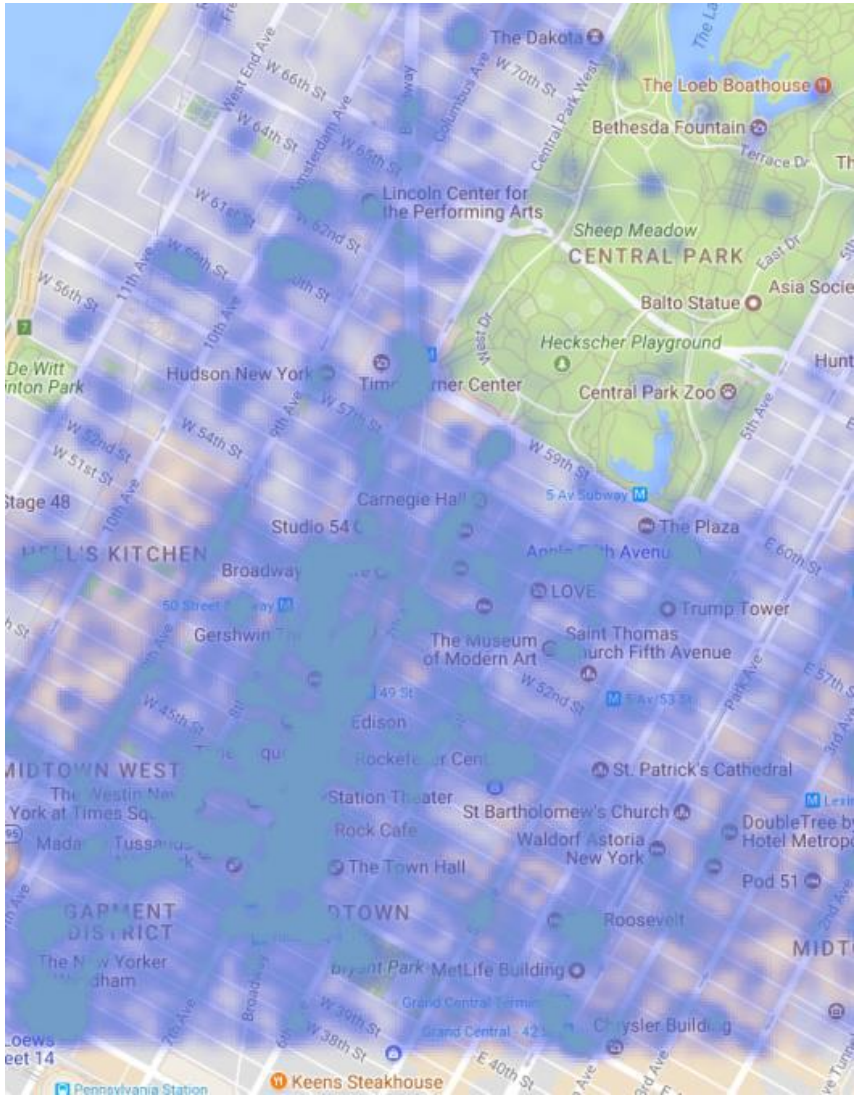
Radius of influence = 10 m

Hard to see what are the significant areas

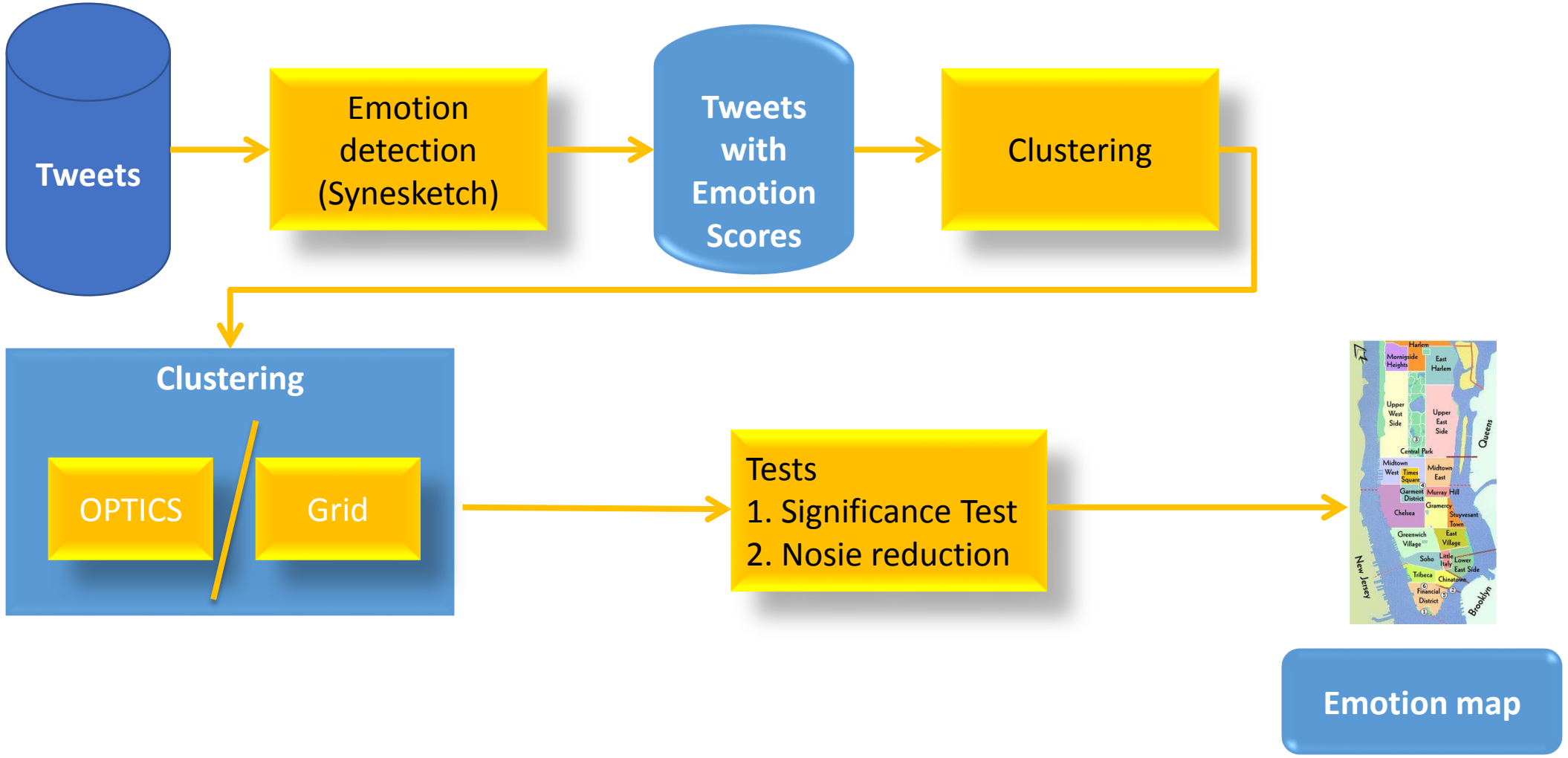
Naïve Heat Map

Sadness

Radius of influence = 10 m



Workflow


Tweets
Emotion detection (Synesketch)
Tweets with Emotion Scores
Clustering
Clustering
OPTICS
Grid
Tests
1. Significance Test
2. Nosie reduction
Emotion map

Emotion Analysis

- We used Synesketch* which provides emotion analysis based on WordNet lexicon, emoticons lexicon and other sources
- The result of the emotion analysis is:
  - A vector of emotions (values in the range [0-1]) for Happiness, Sadness, Fear, Anger, Disgust, Surprise
  - Valence value: 1 for positive, 0 for natural, -1 for negative

* Uros Krcadinac, Philippe Pasquier, Jelena Jovanovic, and Vladan Devedzic. 2013. Synesketch: An open source library for sentence-based emotion recognition. IEEE Transactions on Affective Computing 4, 3 (2013), 312–325

Emotion Analysis (Example)

message	happiness	sadness	fear	anger	disgust	surprise	valence
The city that never sleeps is actually pretty nice. #newyorkcity @ Waldorf Astoria New York http://t.co/2BvbSGrIv9	1	0.266667	0.266667	0	0.266667	0	1
I love tennis.	1	0	0	0.1	0	0	1
Broadway star Elaine Stritch dead at 89: Elaine Stritch, one of the grande dames of Broadway theater, died Monday... http://t.co/LqKyT7T0P1	0.081818	1	0.032	0	0	0.04	-1
First new episode of orange is the new black made me so mad I think I'm done here	0.047059	0.375	0.375	1	0.375	0	-1
Lol aww this fandom is helping eachother with guess the emoji see there is a good side to us	1	0.026667	0.034783	0	0	0	1
Getting made fun of for drinking orange juice. Do people not do that anymore??	1	0.15	0.15	0.05625	0.15	0	1
Its so beautiful today don't wanna do anything but chill	1	0	0	0	0	0	1
I just did a crazy good job at painting my nails	1	0.142857	0.142857	0.142857	0.142857	0	1
Losing yourself in a book then looking up to a beautiful city is the most wonderful feeling http://t.co/gFq4Eek6sK	1	0.135	0.09	0.09	0.04	0.045	1
Happy World Kindness Day! don't forget to smile people	1	0	0	0	0	0	1

Emotion Analysis (Example)

message	happiness	sadness	fear	anger	disgust	surprise	valence
The two best things about soccer: 1. The US is somehow the scrappy underdog. 2. No horrible, idiotic commercials.	1	0.8	0.8	0.8	0.8	0	-1
Watching Tuck Everlasting for the first time, this better be good (: @Loco_Nicoco	1	0.069231	0	0.069231	0.166667	0.061538	1
Me being a political asshole and still ultimately being like Make Love/Not War is directly a result of loving John Lennon from an early age.	1	0.8	0.4	0.5	0.5	0.057143	-1
Siwon is a goodlooking dude. Lol I really wonder where his acting career even went	1	0	0	0	0	0.15	1

Clustering – Grid

- **Tweet**
- **Happy Tweet**

Min tweets for seeds = 5

Min tweets for cell = 3

Xy grid size = 15 [m]

Xy neighbors = 1

Clustering – Grid

Tweet

Happy Tweet

Seed cell

Cluster cell

Min tweets for seeds = 5

Min tweets for cell = 3

Xy grid size = 15 [m]

Xy neighbors = 1

Clustering – Grid

- Tweet
- Happy Tweet
- Seed cell
- Cluster cell
- Tweet in cluster
- Cluster

Min tweets for seeds = 5

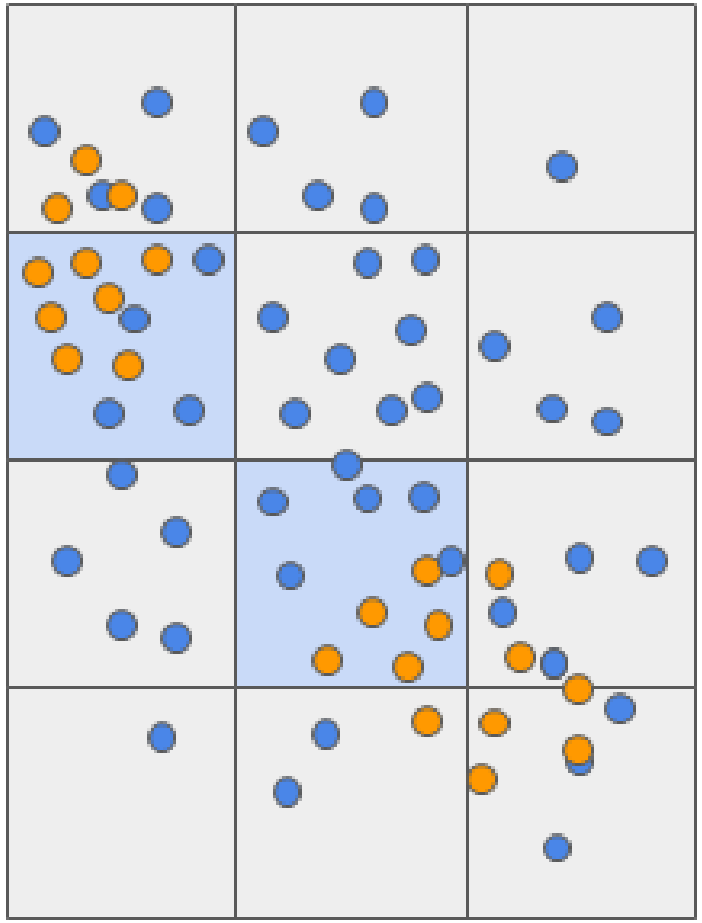
Min tweets for cell = 3

Xy grid size = 15 [m]

Xy neighbors = 1

Clustering – Grid

- The grid partition may split cluster so that the number of relevant posts in each cell would not be enough to consider the cell as relevant

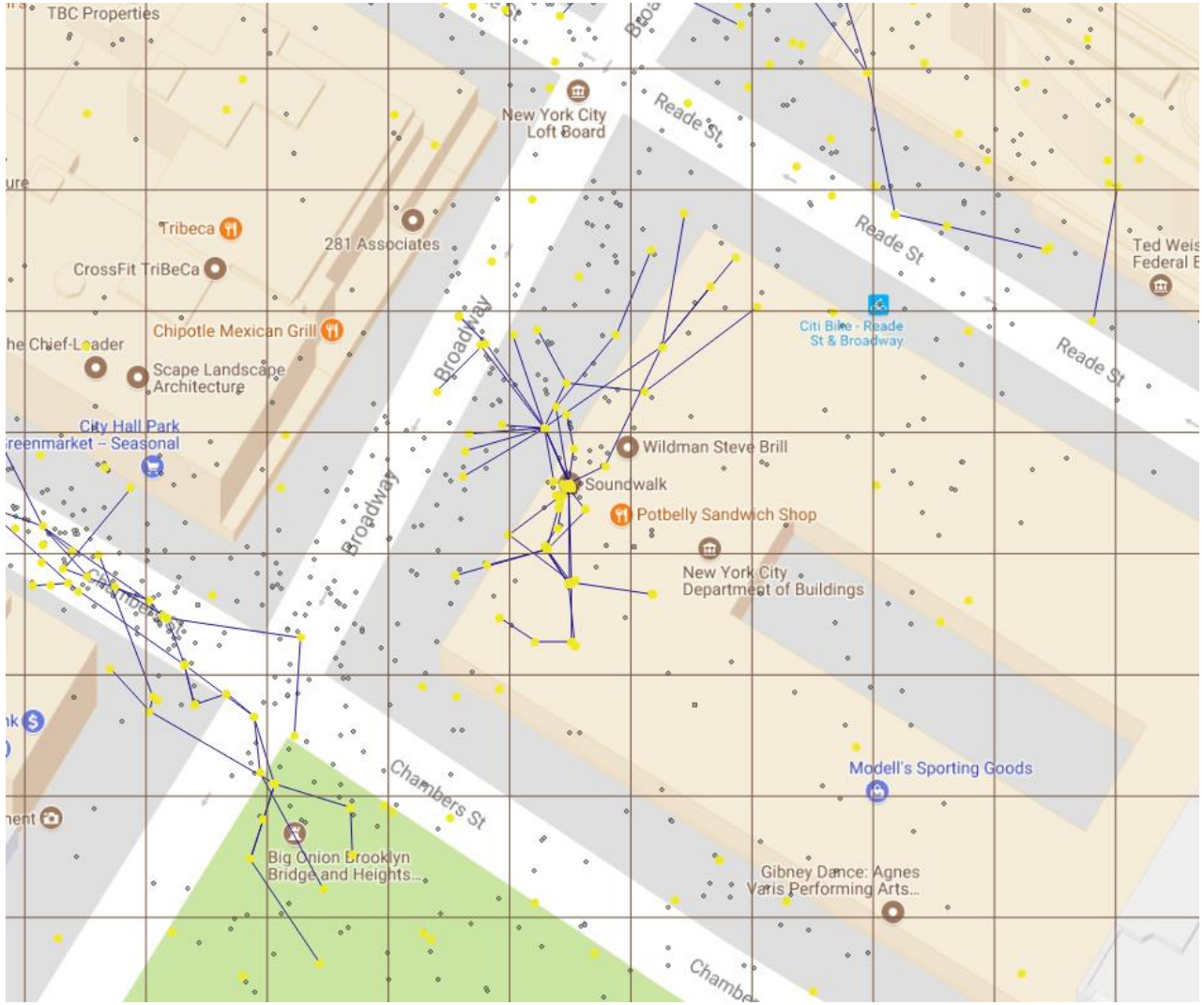


Clustering – OPTICS

Tweet

Happy Tweet

Reachability line (less than 15 m)



Min tweets for seeds = 5

Min tweets for cell = 3

Xy grid size = 15 [m]

Xy neighbors = 1

Clustering – OPTICS

Tweet

Happy Tweet

Reachability line (less than 15 m)

Tweet in cluster

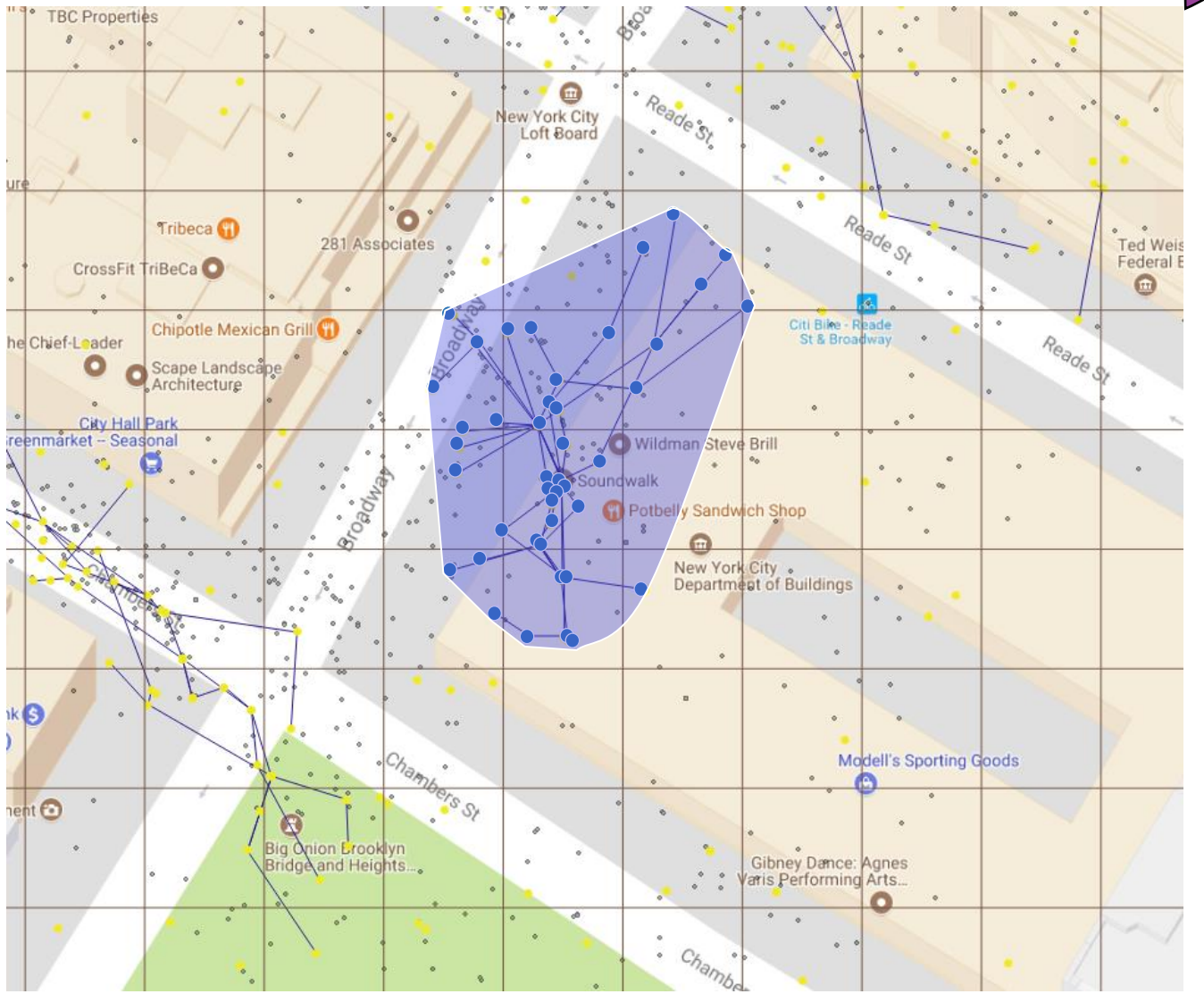
Cluster

Min tweets for seeds = 5

Min tweets for cell = 3

Xy grid size = 15 [m]

Xy neighbors = 1



Significance Test

Binomial test

$$\Pr(X \geq k) = \sum_{i=k}^{m} \binom{m}{i} (q)^i (1-q)^{m-i}$$

where:

$$q = \frac{|posts(D,e)|}{|D|} = posts\ with\ emotion\ /\ all\ posts$$

If $\Pr(X \geq k) \leq 0.05$ then C is significant

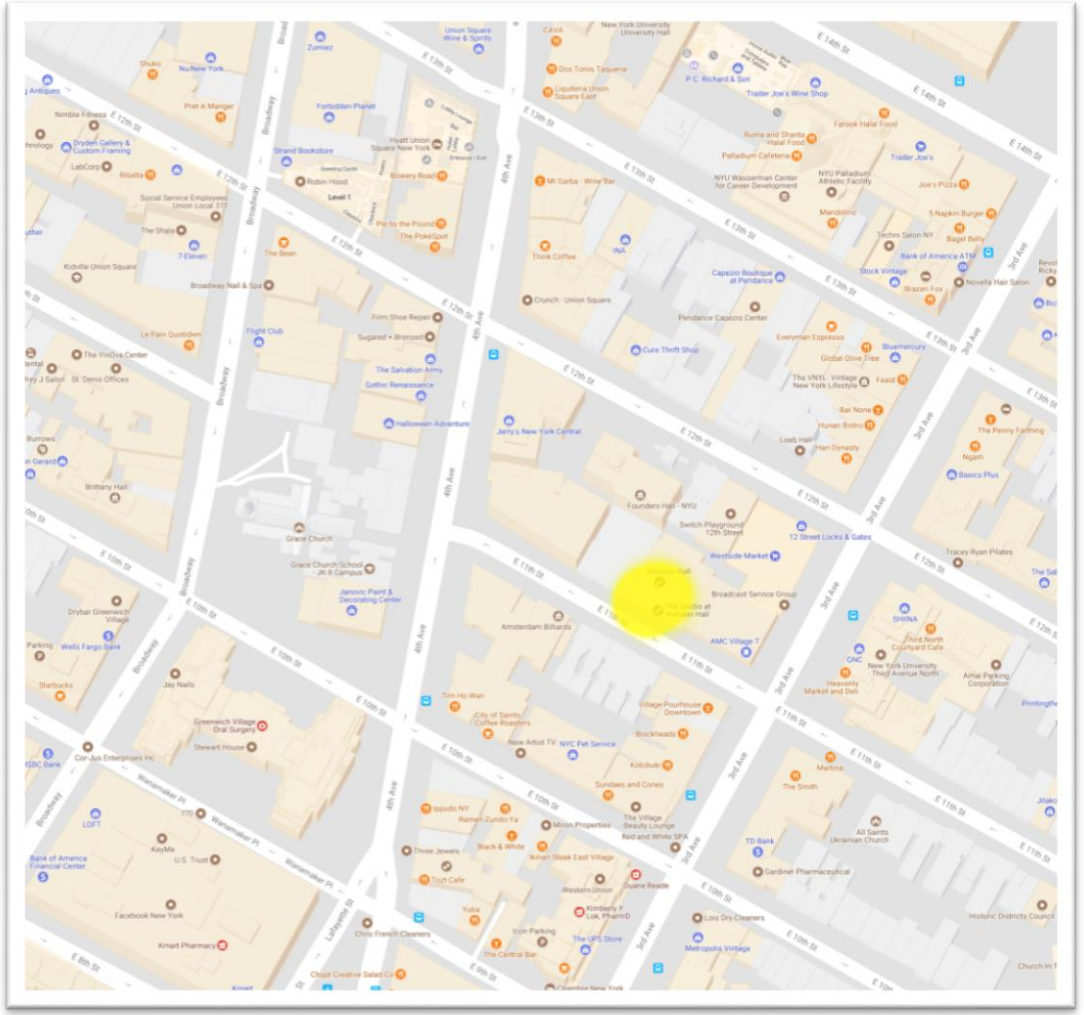
Noise Reduction

- Since binomial test can be biased due to noise in the data we discard clusters with:
  - Low number of users
  - Low number of tweets
  - Minimum duration

Anecdotal example: tweets with the word MAD were analyzed as ‘anger’, so there were many posts associated with anger in the area of the Museum of Art and Design

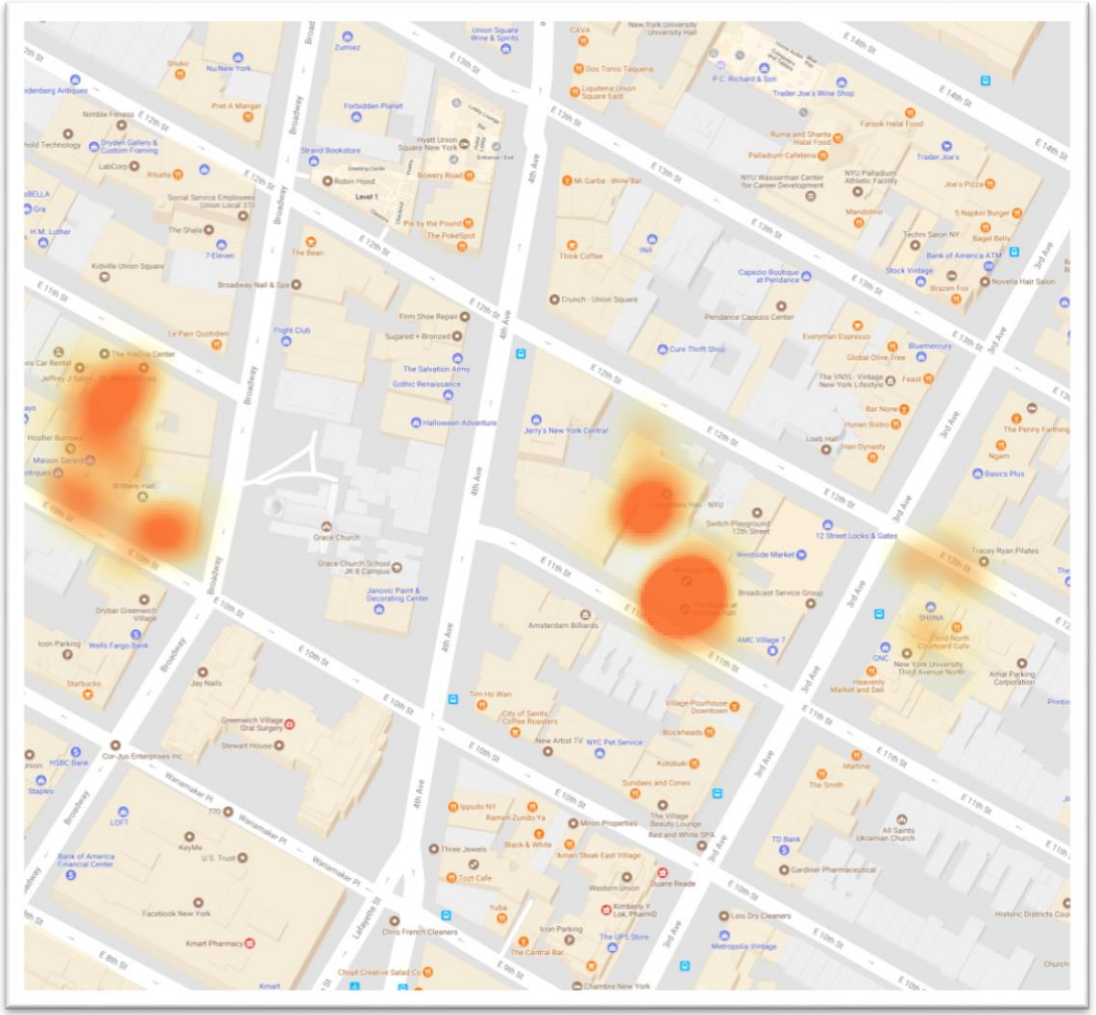
Discovered Areas – Happiness

OPTICS

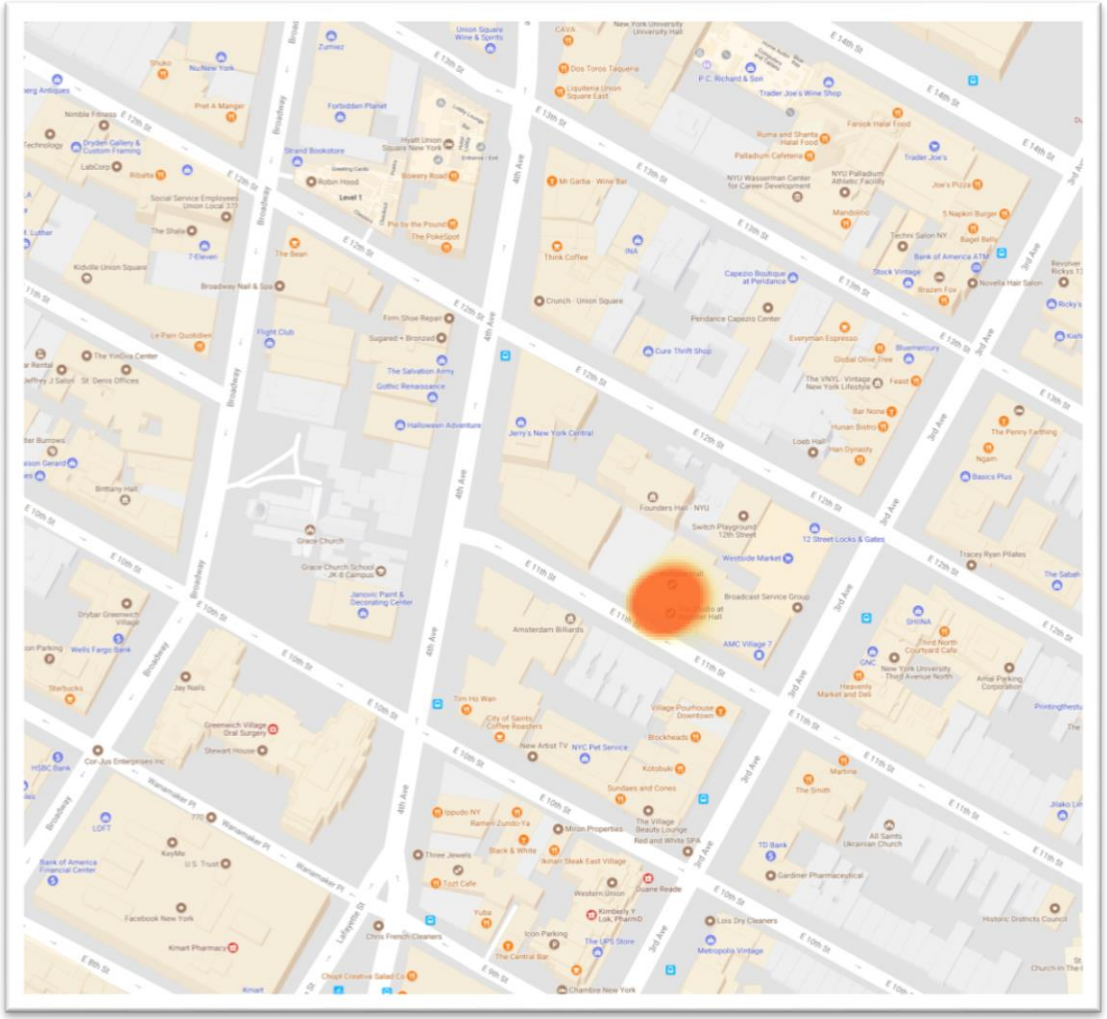


Grid

Discovered Areas – Anger

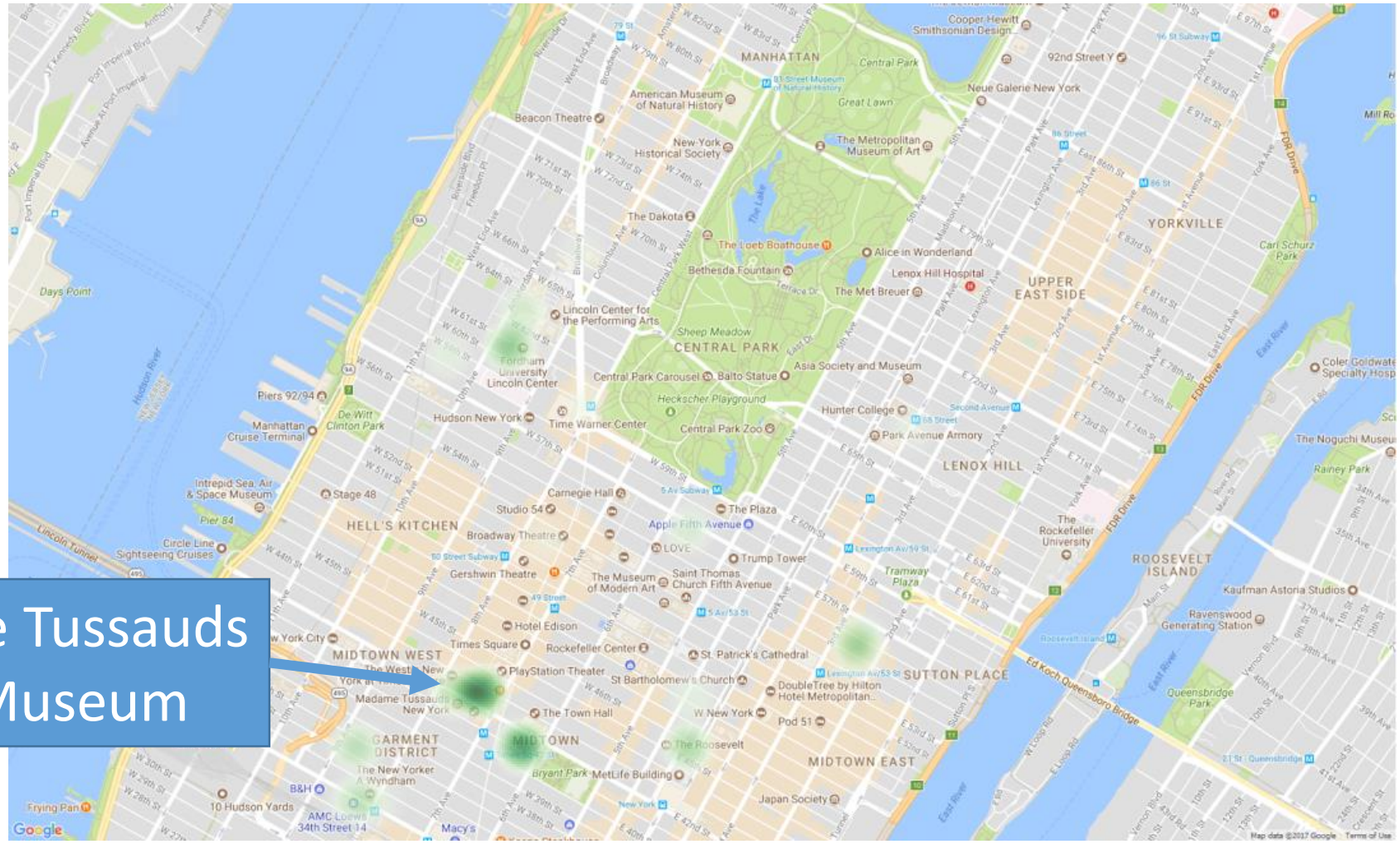


OPTICS



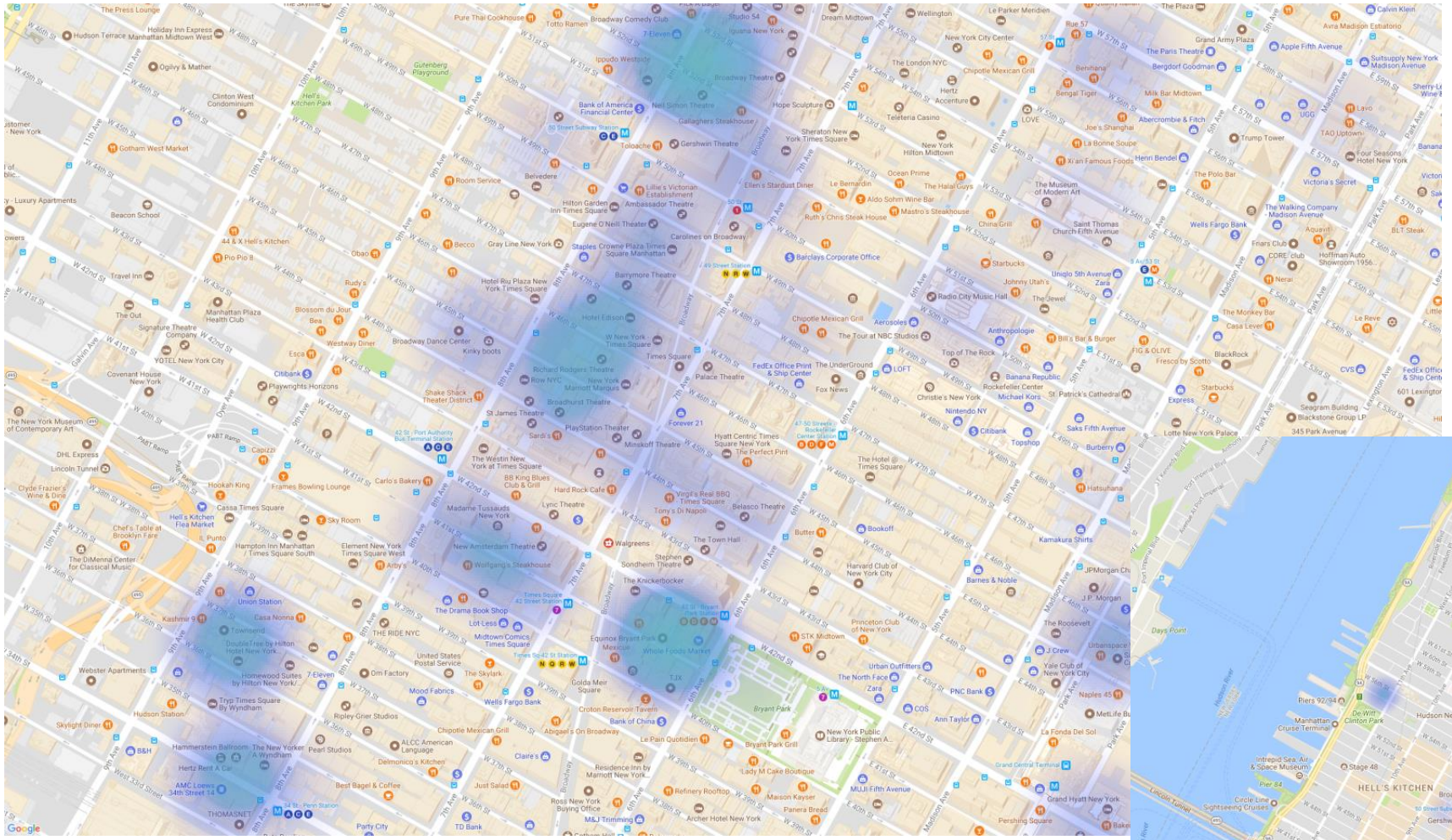
Grid

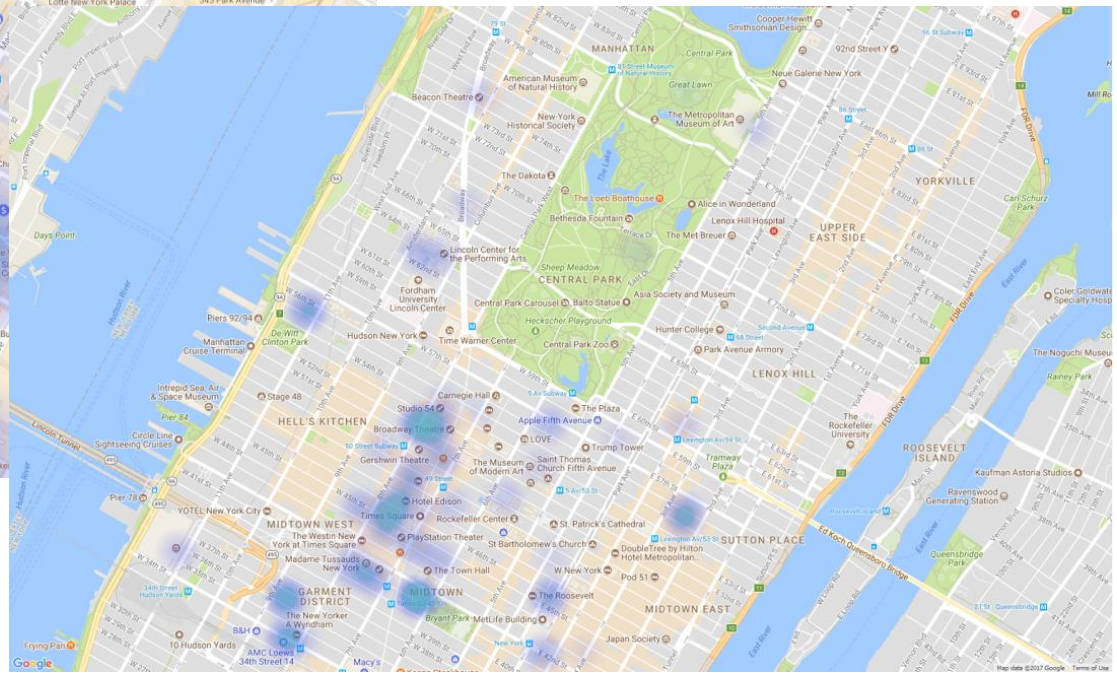
Discovered Areas – Fear



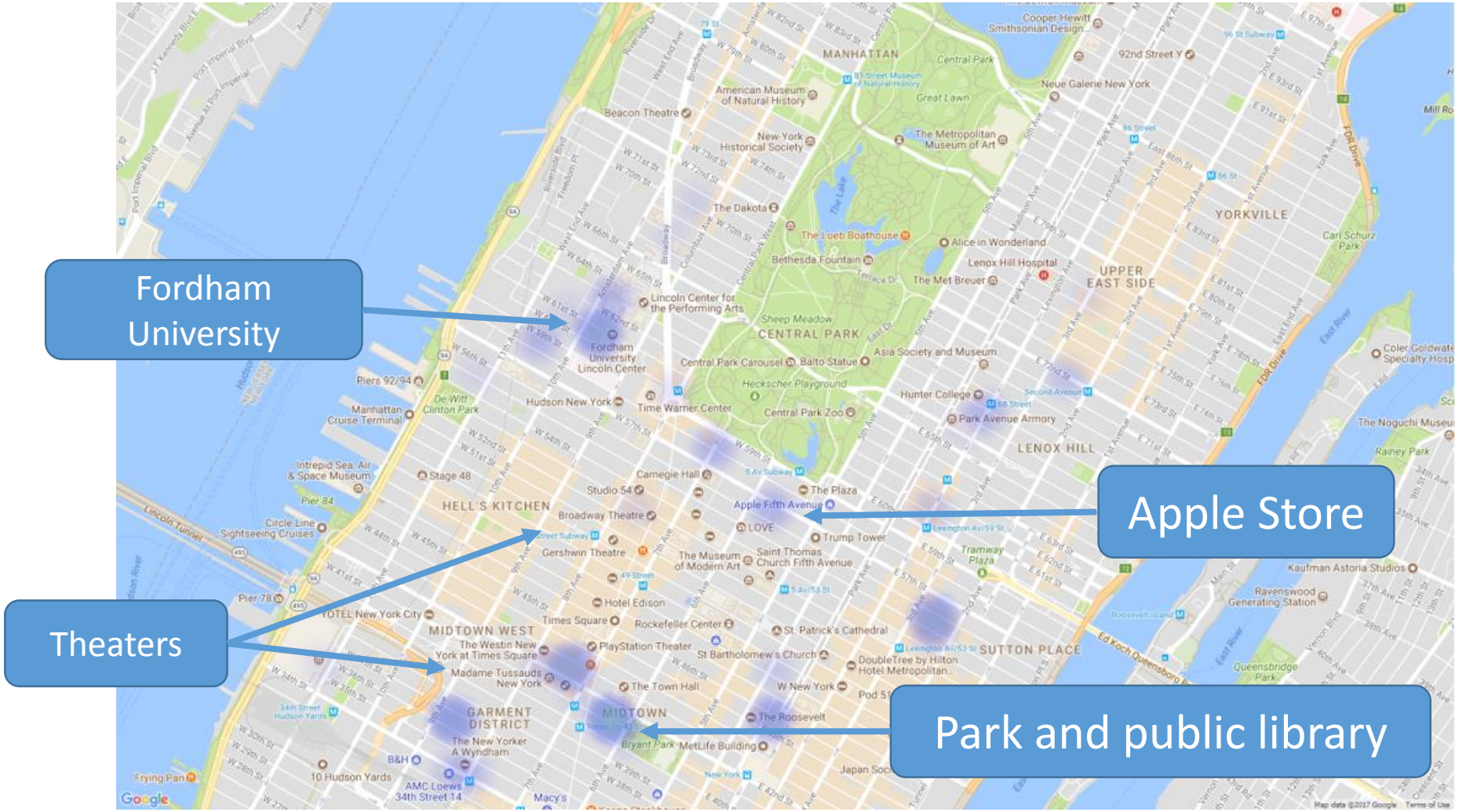
Madame Tussauds Wax Museum

Discovered Areas – Surprise





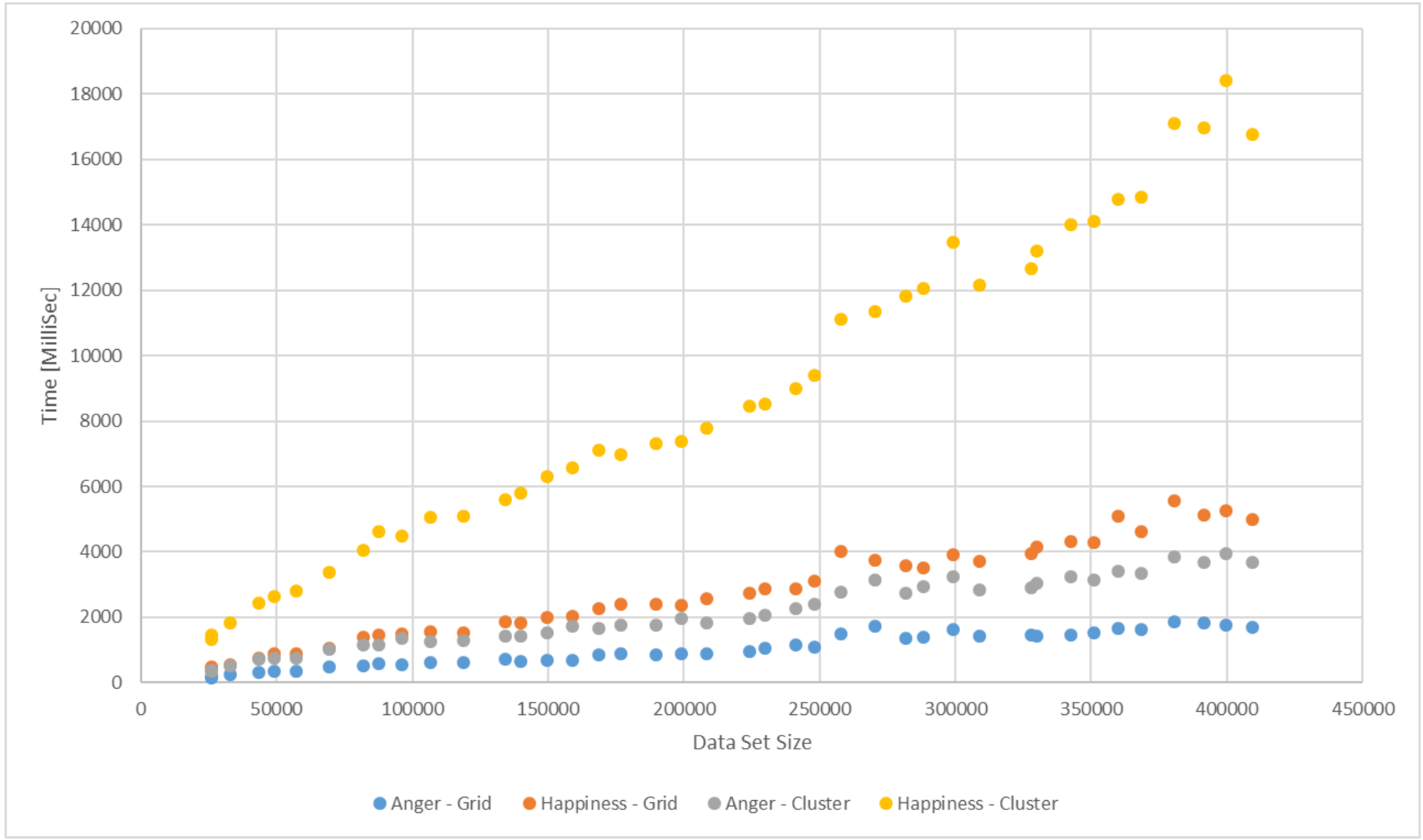
Discovered Areas – Sadness



Quantitative Evaluation

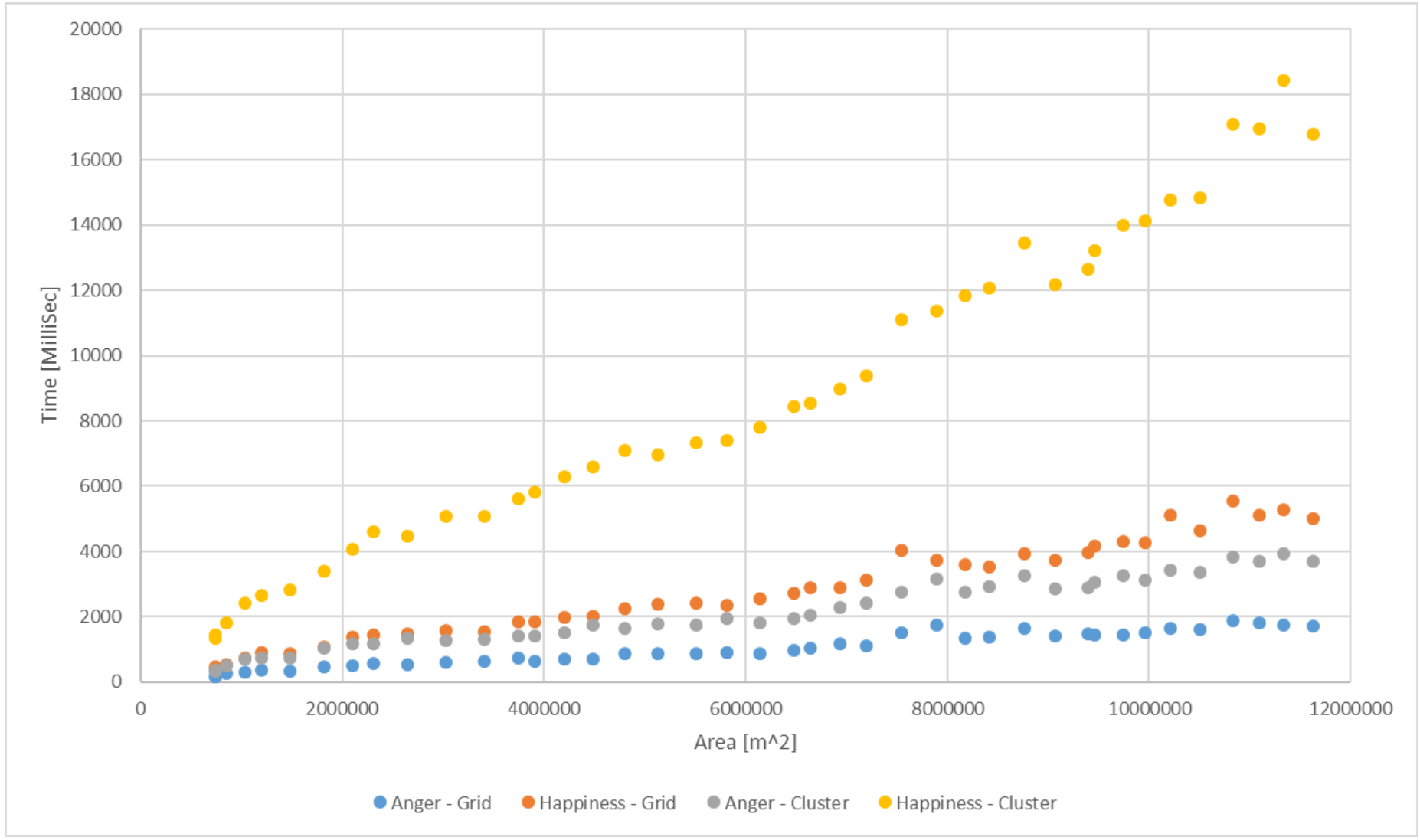
- High emotional activity in areas of theaters
- Anger and sadness in areas of school
- Fear in universities and colleges (more anxiety than fear)
- Anger in transportation hubs, train stations, etc.
- Surprise in the area of the opera building and in campuses
- Happiness in places like YMCA, Washington Square, Central Park
- Disgust in the area of the *Art and Design High School*
- Happiness and surprise in restaurants (but w.r.t. the food)

Experiments results - performance



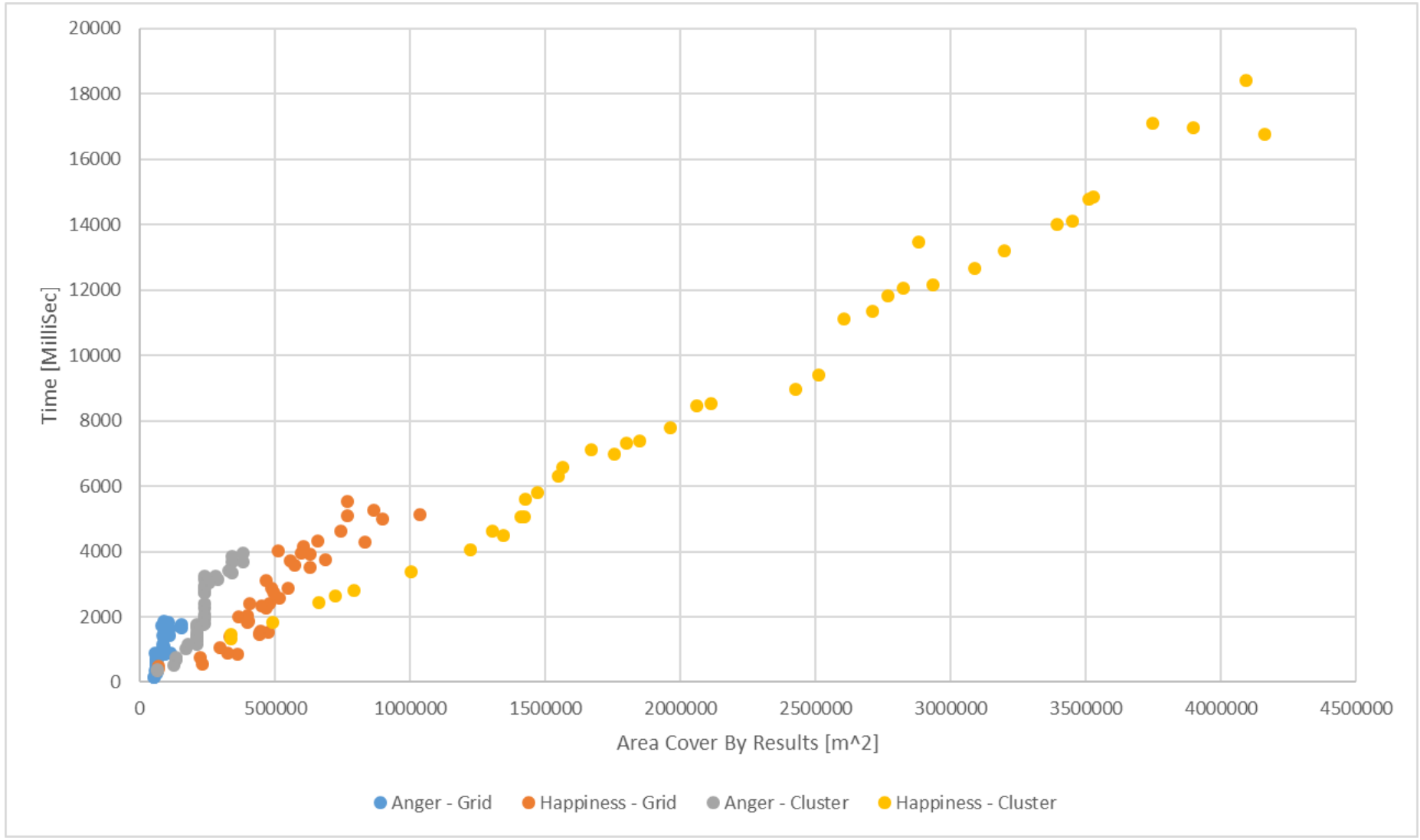
Running time as function of dataset size

Experiments results - performance



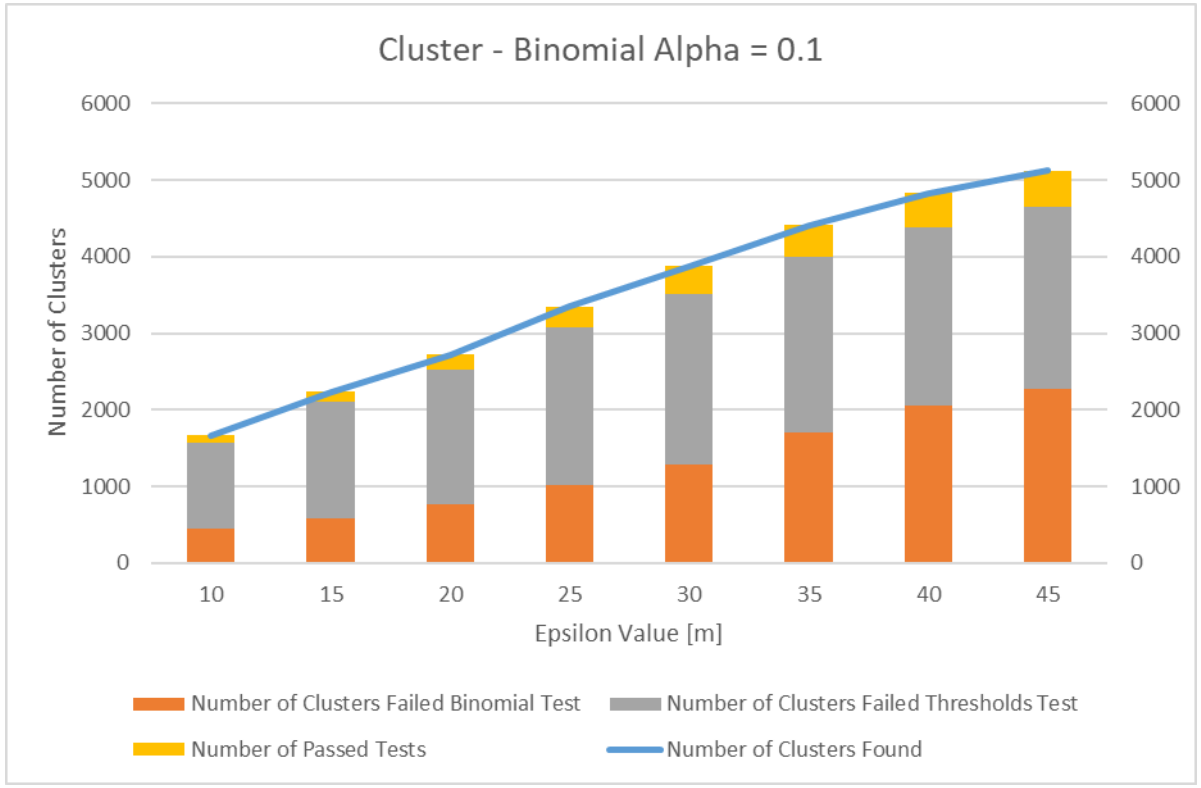
Running time as function of analyzed area

Experiments results - performance

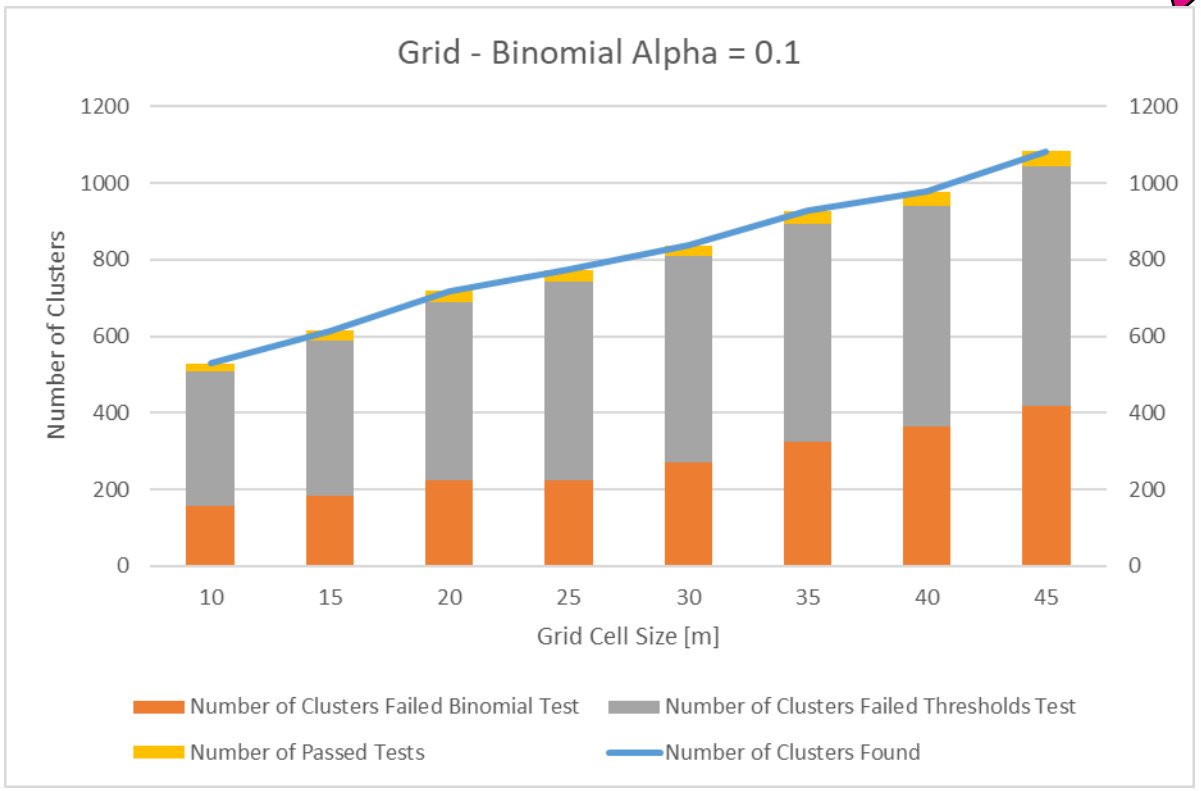


Running time as function of the results area (returned clusters)

Experiments results - performance



Number of clusters found based as function of ε size [m]



Number of clusters found based as function of cell size (x,y) [m]

Conclusions

- We show how to create emotion maps from a large dataset of geotagged tweets
- We examined two methods to build emotion maps: clustering grid cells (Grid) and clustering posts (OPTICS)
- We tested the performance of both methods and show:
  - The OPTICS method is slower but more accurate
  - The Grid method is faster but less accurate
- Future work include investigating testing in depth particular usages of emotion maps

thank you!

Emotion Analysis (Example)

user_id	message	happiness	sadness	fear	anger	disgust	surprise	valence
288540158	@lukeoneil47 this is kind of amazing to me that I follow heartsrevolution but not you	1	0	0	0	0.25	1	1
340439937	We all did it. Ran away... I moved to New York with a dollar and a dream.	0.2666	0.266667	0.1125	0.1	0.066667	0.1	-1
1061388296	Today will be the day I lose control of all self control and fucking kill somebody #getoutoftheway	0.8	0.8	0.9	1	0.7	0.061538	-1
950531	The staff of The Wire dot com is having some #smart debate about murder and drugs.	0.133333	0.125	0	0	0	0	1
14205096	Wonder what combination of sites put me into this ad targeting pool... http://t.co/TxxdEwsdep	0	0	0	0	0	0.15	0
1213642687	Bout to check out an @EW showing of #Her. Going to just listen to Scarlett Johansson's voice for an hour and a half. #oscarseason	0.1111111	0.05	0	0	0	0	1