Chicago Food Inspections

Recent watchdog report published by **Chicago Tribune** indcated that food safety inspectors overlook hundreds of day cares in the city of Chicago.

The key take away from the Chicago Tribune watchdog report is that the city had only 33 working field inspectors to cover the entire city of Chicago. Many of the facilties serve food for Children, and while few fail inspectionns, many escape routine inspections.

Here the goal is to identify the **hot-spots** (areas that have facilities serving food to children and have failed inspections in the past) on the Chicago map to dispatch inspectors to.

To achive this goal, these are the necessary steps:

1. Dataset for Chicago Food Inspections
2. NoSQL database Egnine (ElasticSearch) for indexing and data retrieval
3. HeatMap to plot the children facilties that failed Chicago Food Inspections

Loading the Dataset CSV file

Description of the dataset:

1. It has 164953 inspection records
2. It has inspection records from 2010 to 2018
3. It has 17 fields

In [1]:
```
# Load the CSV Chicago Food Inspections dataset into a dataframe
import pandas as pd
import numpy as np

df = pd.read_csv("C:\\Users\\richd\\420\\Food_Inspections.csv")
```

In [2]:
```
df.head()
```

Out[2]:

	Inspection ID	DBA Name	AKA Name	License #	Facility Type	Risk	Address	City	St
0	2561538	PACINO'S RC, LLC	PACINOS	2683667.0	Restaurant	Risk 1 (High)	1010 S DELANO CT	CHICAGO	
1	2556917	BISTRO	BISTRO	2846045.0	Restaurant	Risk 1 (High)	1400 S JEAN BAPTISTE POINTE DUSABLE LAKESHORE DR	CHICAGO	
2	2549763	DANIEL WILLIAM HALE	DANIEL WILLIAM HALE	66311.0	School	Risk 1 (High)	4934 S Wabash (45E) (C/Shabazz)	CHICAGO	
3	2492473	DANIEL WILLIAM HALE	DANIEL WILLIAM HALE	66311.0	School	Risk 1 (High)	4934 S Wabash (45E) (C/Shabazz)	CHICAGO	
4	2384228	YOUTH CONNECTION	YOUTH CONNECTION LEADERSHIP ACADEMY	66101.0	School	Risk 2 (Medium)	3424 S State (1E&W) ST	CHICAGO	

There are few fields in the dataset of interest:

1. Risk
2. Results
3. Latitude
4. Longtitude
5. Inspection ID

There are possibilities that the data entry clerk might've made some typos and misspellings and there are different words meant to indicate the same thing, some examples of this:

- Children
- Children's
- Childrens

In [83]:
```
#Import Elascticsearch and helpers from  elasticsearch

from elasticsearch import Elasticsearch, helpers


es=Elasticsearch('http://student:spsdata@129.105.248.25:9200')
```

Load and Index the Inspection Records into ElasticSearch

Inspection records are insreted into ElasticSearch engine using the bulk Api of elastic search.

Here is the link **API DOCS** for the API documentation.

Query is used to retieve data from ElasticSearch server

The query is used to retrieve data from ElasticSearch servers that match certain filters.

Three main experiments and will compare results for each:

1. Experiment #1: Using Regular Expressions using the term Children
2. Experiment #2: Using Fuziness using the term Children's
3. Experiment #3: Using Fuziness using the term Children

Experiment #1: Create the query using regex

In [4]:
```
query = {
        'size' : 10000,
        'query': {
            'bool': {
                    'must' : [{'match' : {'Results': 'Fail'}}, {"match" : {'Risk': {"c


                              {"query_string": {
                                            "query": "*Children*",  #using regex of ch
                                            "fields": ["Facility Type","Violations","D
                                             }
                             }


                             ]
                    }
                }
        }
results = es.search(index='food_inspections', body=query, scroll='1h')
```

In [5]:
```
sid = results['_scroll_id']
scroll_size = results['hits']['total']

print('sid = ', sid)
print('Scroll Size = ', scroll_size)
```

```
sid =  DnF1ZXJ5VGhlbkZldGNoCgAAAAAD1EWVFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RFmBZsUk
40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPURZYWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1EWXFmxSTjR
3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RFmxZsUk40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPURZkWbFJONHdM
UGxRei1DZlFDS2hjOUZDQQAAAAAD1EWeFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RFmhZsUk40d0xQb
FF6LUNmUUNLaGM5RkNBAAAAAAPURZ0WbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1EWcFmxSTjR3TFBsUX
otQ2ZRQ0toYzlGQ0E=
Scroll Size =  601
```

In [6]:
```
type(results)
```

Out[6]:
```
dict
```

Process the retrieved documents and filter fields for the Heatmap

Create a list-of-lists of the two fields, (Latitude and Longitude) for the HeatMap

In [9]:
```
len(results['hits']['hits'])
```

Out[9]:
```
601
```

In [10]:
```
count = 0
list_of_lAT_LONG_pairs = []
while(scroll_size > 0):

    for inspection in results['hits']['hits']:                    #Iterating each  resu
        current_location_lAT_LONG = []
        document = inspection['_source']
        count = count +1

        #defensive coding to ensure we have the fields in the inspection documents
        if 'Latitude' in document.keys():
            if 'Longitude' in document.keys():
                if 'Address' in document.keys():
                    if(document['Latitude'] != None and document['Longitude'] != None
                        current_location_lAT_LONG.append(float(document['Latitude']))
                        current_location_lAT_LONG.append(float(document['Longitude']))
                        list_of_lAT_LONG_pairs.append(current_location_lAT_LONG)

    results = es.scroll(scroll_id = sid, scroll = '2m')
    sid = results['_scroll_id']                                   #Changing the scroll-i
    scroll_size = len(results['hits']['hits'])

print("the total number of match with children using wild card:",count)
```

```
the total number of match with children using wild card: 601
```

In [11]:
```
document.keys()
```

Out[11]:
```
dict_keys(['Inspection ID', 'DBA Name', 'AKA Name', 'License #', 'Facility Type', 'Ri
sk', 'Address', 'City', 'State', 'Zip', 'Inspection Date', 'Inspection Type', 'Result
s', 'Violations', 'Latitude', 'Longitude', 'Location'])
```

In [12]:
```
list_of_lAT_LONG_pairs[:3]
```

Out[12]:
```
[[41.8814369069, -87.6659213595],
 [41.760441801, -87.6735652436],
 [41.9531127244, -87.7800185741]]
```

In [13]:
```
len(list_of_lAT_LONG_pairs)
```

Out[13]:
```
601
```

Install folium package to plot the Map and Heatmaps

In [14]:
```
import folium
from folium import plugins

print(folium.__version__)
```

```
0.13.0
```

In [15]:
```
chicago_map = folium.Map([41.90293279, -87.70769386], zoom_start=11)
chicago_map
```

Out[15]: Make this Notebook Trusted to load map: File -> Trust Notebook

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Create the HeatMap

In [16]:
```
# Plot the query matches on Chicago HeatMap

chicago_map.add_child(plugins.HeatMap(list_of_lAT_LONG_pairs, radius=15))
chicago_map
```

Out[16]: Make this Notebook Trusted to load map: File -> Trust Notebook

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Create the query using fuzziness

Experiment #2: Run a fuzzy query using the ~ operator and the term Children:

- "query": "Children~2"

In [17]:
```
query = {
        'size' : 10000,
        'query': {
            'bool': {

                    'must' : [{'match' : {'Results': 'Fail'}}, {"match" : {'Risk': {"c

                            {"query_string": {
                                            "query": "Children~2",
                                            "fields": ["Facility Type","Violations","D
                                             }
                            }

                            ]
                        }
                    }
        }
results = es.search(index='food_inspections', body=query,scroll='1h')
```

In [19]:
```
sid = results['_scroll_id']
scroll_size = results['hits']['total']
```

In [20]:
```
print('sid = ', sid)
print('Scroll Size = ', scroll_size)
```

```
sid =  DnF1ZXJ5VGhlbkZldGNoCgAAAAAD1EWoFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RFpxZsUk
40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPURaYWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1EWkFmxSTjR
3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RFpRZsUk40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPURakWbFJONHdM
UGxRei1DZlFDS2hjOUZDQQAAAAAD1EWrFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RFrBZsUk40d0xQb
FF6LUNmUUNLaGM5RkNBAAAAAAPURaoWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1EWtFmxSTjR3TFBsUX
otQ2ZRQ0toYzlGQ0E=
Scroll Size =  602
```

In [21]:

```
count = 0
list_of_lAT_LONG_pairs = []

while(scroll_size > 0):

    for inspection in results['hits']['hits']:
        current_location_lAT_LONG = []
        document = inspection['_source']
        count = count +1

        #defensive coding to ensure we have the fields in the inspection documents
        if 'Latitude' in document.keys():
            if 'Longitude' in document.keys():
                if 'Address' in document.keys():
                    if(document['Latitude'] != None and document['Longitude'] != None
                        current_location_lAT_LONG.append(float(document['Latitude']))
                        current_location_lAT_LONG.append(float(document['Longitude']))
                        list_of_lAT_LONG_pairs.append(current_location_lAT_LONG)

    results = es.scroll(scroll_id = sid, scroll = '2m')
    sid = results['_scroll_id']
    scroll_size = len(results['hits']['hits'])

print("Total number of query matches with children using fuziness:",count)
```

```
Total number of query matches with children using fuziness: 602
```

Experiment #3: Run a fuzzy query using the ~ operator and the term Children's :

- "query": "Children's~2"

In [48]:

```
query = {
        'size' : 10000,
        'query': {
            'bool': {
                    'must' : [{'match' : {'Results': 'Fail'}}, {"match" : {'Risk': {"c

                            {"query_string": {
                                            "query": "Children's~2",
                                            "fields": ["Facility Type","Violations","D
                                             }
                            }

                            ]
                        }
                    }
        }
results = es.search(index='food_inspections', body=query,scroll='1h')
```

In [24]:
```
sid = results['_scroll_id']
scroll_size = results['hits']['total']
```

In [25]:
```
print('sid = ', sid)
print('Scroll Size = ', scroll_size)
```

```
sid =  DnF1ZXJ5VGhlbkZldGNoCgAAAAAD1EWvFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RFrhZsUk
40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPURbAWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1EWyFmxSTjR
3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RFsRZsUk40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPURbYWbFJONHdM
UGxRei1DZlFDS2hjOUZDQQAAAAAD1EWzFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RFtBZsUk40d0xQb
FF6LUNmUUNLaGM5RkNBAAAAAAPURbcWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1EW1FmxSTjR3TFBsUX
otQ2ZRQ0toYzlGQ0E=
Scroll Size =  611
```

In [26]:
```
count = 0
list_of_lAT_LONG_pairs = []

while(scroll_size > 0):

    for inspection in results['hits']['hits']:
        current_location_lAT_LONG = []
        document = inspection['_source']
        count = count +1

        #defensive coding to ensure we have the fields in the inspection documents
        if 'Latitude' in document.keys():
            if 'Longitude' in document.keys():
                if 'Address' in document.keys():
                    if(document['Latitude'] != None and document['Longitude'] != None
                        current_location_lAT_LONG.append(float(document['Latitude']))
                        current_location_lAT_LONG.append(float(document['Longitude']))
                        list_of_lAT_LONG_pairs.append(current_location_lAT_LONG)

    results = es.scroll(scroll_id = sid, scroll = '2m')
    sid = results['_scroll_id']
    scroll_size = len(results['hits']['hits'])

print("Total number of match with Children's using fuziness:",count)
```

```
Total number of match with Children's using fuziness: 611
```

In [27]:
```
chicago_map = folium.Map([41.90293279, -87.70769386], zoom_start=11)
chicago_map
```

Out[27]: Make this Notebook Trusted to load map: File -> Trust Notebook

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In [28]:
```
# Plot the  query matches for  "Children's" on Chicago HeatMap

chicago_map.add_child(plugins.HeatMap(list_of_lAT_LONG_pairs, radius=15))
chicago_map
```

Out[28]: Make this Notebook Trusted to load map: File -> Trust Notebook

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Frequent Violators

Experiment #4: Get the top list of frequent violators:

Facilities that serve children can be classified under different Facility Types:

1. Daycare Above and Under 2 Years
2. Children's Services Facility
3. Daycare (2 - 6 Years)

Use ELasticSearch and Folium to plot on the map those facilities that **failed inspection at least 5 times with risk high**.

In [29]:
```
query ={
      'size' : 10000,
      'query': {
          "bool" : {
              "should":[    {'match' : {'Facility Type': {"query" : 'Daycare (2 - 6 Ye
                            {'match' : {'Facility Type':{"query" : 'Daycare Above and
                            {'match' : {'Facility Type':{"query" : 'CHILDRENS SERVICES
                        ],
                        "minimum_should_match" : 1,
                        "filter" : [{"match" : {'Results': {"query": 'Fail', "operator'
                                    {"match" : {'Risk': {"query": 'Risk 1 (High)', "ope
                                   ]

              }
      },
      "aggs" : {
          "selected_dbas" :{
                          "terms" : {
                                        "field" : "DBA Name.keyword",
                                        "min_doc_count": 5,
                                        "size" :10000

                                     },
                          "aggs": {
                              "top_dba_hits": {
                                  "top_hits": {
                                  "size": 10
                                  }
                              }
                 }


        }
    }
}

results = es.search(index='food_inspections', body=query,scroll='1h')
```

In [31]:
```
list_of_lAT_LONG_pairs = []

for dba_bucket in results["aggregations"]["selected_dbas"]["buckets"]:
    if "top_dba_hits" in dba_bucket and "hits" in dba_bucket["top_dba_hits"] and "hits

        for hit in dba_bucket["top_dba_hits"]["hits"]["hits"]:

            if "_source" in hit:

                if "Latitude" in hit["_source"] and "Longitude" in hit["_source"]:
                    list_of_lAT_LONG_pairs.append([hit["_source"]["Latitude"], hit["_s
```

```
# Lets dumps the LAt and LONG
# list_of_LAT_LONG_pairs
```

In [32]:
```
# Dump the hits per bucket into a datframe object for all buckets

row_index =0
df_top_frequent_violators = pd.DataFrame()
for dba_bucket in results["aggregations"]["selected_dbas"]["buckets"]:
    if "top_dba_hits" in dba_bucket and "hits" in dba_bucket["top_dba_hits"] and "hits
        doc_count = dba_bucket['doc_count']
        for hit in dba_bucket["top_dba_hits"]["hits"]["hits"]:
            score = hit['_score']
            if "_source" in hit:
                row_index += 1
                df_frequent_violator = pd.DataFrame(hit['_source'],index =[row_index])
                df_frequent_violator['doc_count'] = doc_count
                df_frequent_violator['score'] = score
                df_top_frequent_violators = df_top_frequent_violators.append(df_freque
```

```
C:\Users\richd\AppData\Local\Temp\ipykernel_260784\3073063049.py:15: FutureWarning: T
he frame.append method is deprecated and will be removed from pandas in a future vers
ion. Use pandas.concat instead.
  df_top_frequent_violators = df_top_frequent_violators.append(df_frequent_violator)
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```

In [33]:
```
df_top_frequent_violators
```

Out[33]:

	Inspection ID	DBA Name	AKA Name	License #	Facility Type	Risk	Address	City	State	Zip
1	1319663	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	2215472.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0
2	1229713	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	3793.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0
3	1515476	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	2215472.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0
4	1229852	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	1194190.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0
5	1386187	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	2215472.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0
...	...	...	...	...	...	...	...	...	...	...
147	285066	THE EDSEL ALBERT AMMONS NURSER	THE EDSEL ALBERT AMMONS NURSER	15803.0	Daycare (2 - 6 Years)	Risk 1 (High)	549 E 76TH ST	CHICAGO	IL	60619.0
148	1235065	THE EDSEL ALBERT AMMONS NURSER	THE EDSEL ALBERT AMMONS NURSER	15803.0	Daycare (2 - 6 Years)	Risk 1 (High)	549 E 76TH ST	CHICAGO	IL	60619.0
149	1158446	THE EDSEL ALBERT AMMONS NURSER	THE EDSEL ALBERT AMMONS NURSER	15803.0	Daycare (2 - 6 Years)	Risk 1 (High)	549 E 76TH ST	CHICAGO	IL	60619.0
150	545232	THE EDSEL ALBERT AMMONS NURSER	THE EDSEL ALBERT AMMONS NURSER	15803.0	Daycare (2 - 6 Years)	Risk 1 (High)	549 E 76TH ST	CHICAGO	IL	60619.0

	Inspection ID	DBA Name	AKA Name	License #	Facility Type	Risk	Address	City	State	Zip
151	1234922	THE EDSEL ALBERT AMMONS NURSER	THE EDSEL ALBERT AMMONS NURSER	15803.0	Daycare (2 - 6 Years)	Risk 1 (High)	549 E 76TH ST	CHICAGO	IL	60619.0

151 rows × 19 columns

In [34]:
```
# Print the number of violations for every DBA NAME

df_top_frequent_violators['DBA Name'].value_counts()
```

Out[34]:
```
BUSY BUMBLE BEE ACADEMY DAYCARE                          9
BOTTLES TO BOOKS LEARNING CENTER                         8
A CHILD'S WORLD EARLY LEARNING CENTER                    7
AMAZING GRACE DAYCARE CENTER                             7
KIDS R FIRST LEARNING ACADEMY                            6
Little People's Day Care & Kindergarten, Inc.            6
LITTLE KIDS VILLAGE LEARNING                             6
LINCOLN KING DAY CARE                                    6
THE WORLD IS YOUR'S CHILD CARE & LEARNING CENTER INC.    6
JELLYBEAN LEARNING CENTER                                6
EARLY CHILDHOOD EDUCARE CENTER                           6
DISCOVERY LEARNING ACADEMY, INC.                         6
COMMONWEALTH DAYCARE CENTER                              6
FIRMAN COMMUNITY SERVICES                                6
KENYATTA'S DAYCARE                                       5
THE CRYSTAL PALACE EARLY LITERACY ZONE                   5
MONTESSORI ACDY. INFT/TOD. CNT                           5
MOLADE' CHILD DEVELOPMENT CENTER                         5
LAKE & PULASKI CHILD DEVELOPMENT CENTER                  5
EZZARD CHARLES DAYCARE CENTER                            5
GREATER INSTITUTE AME CHURCH                             5
GRANT DAY CARE INC                                       5
CENTRO INFANTIL                                          5
ANGELS                                                   5
ADA S MCKINLEY MAGGIE DRUMMON                            5
THE EDSEL ALBERT AMMONS NURSER                           5
Name: DBA Name, dtype: int64
```

In [36]:
```
# Plot the top frequent violators on Chicago HeatMap

chicago_map.add_child(plugins.HeatMap(list_of_lAT_LONG_pairs, radius=15))
chicago_map
```

Out[36]: Make this Notebook Trusted to load map: File -> Trust Notebook

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Leaflet (https://leafletjs.com) | Data by © OpenStreetMap (http://openstreetmap.org), under ODbL (http://www.openstreetmap.org/copyright).

In [53]:
```
# Experiment 1 Query

query = {
        'size' : 10000,
        'query': {
            'bool': {
                    'must' : [{'match' : {'Results': 'Fail'}}, {"match" : {'Risk': {"c


                              {"query_string": {
                                            "query": "*Child*",  #using regex of child
                                            "fields": ["Facility Type","Violations","D
                                             }
                            }


                            ]
                    }
                }
        }
results = es.search(index='food_inspections', body=query, scroll='1h')
```

In [54]:
```
# Experiment 1 Results

sid = results['_scroll_id']
scroll_size = results['hits']['total']
max_score = results['hits']['max_score']

print('sid = ', sid)
print('Scroll Size = ', scroll_size)
print('Max Score = ', max_score)
```

```
sid =  DnF1ZXJ5VGhlbkZldGNoCgAAAAAD1EnqFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RJ7BZsUk
40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPUSe4WbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1EnwFmxSTjR
3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RJ6xZsUk40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPUSe0WbFJONHdM
UGxRei1DZlFDS2hjOUZDQQAAAAAD1EnxFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RJ7xZsUk40d0xQb
FF6LUNmUUNLaGM5RkNBAAAAAAPUSfIWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1EnzFmxSTjR3TFBsUX
otQ2ZRQ0toYzlGQ0E=
Scroll Size =  774
Max Score =  3.5609713
```

In [55]:

```
# Experiment 1 Heatmap

count = 0
list_of_lAT_LONG_pairs = []
while(scroll_size > 0):

    for inspection in results['hits']['hits']:                    #Iterating each  resu
        current_location_lAT_LONG = []
        document = inspection['_source']
        count = count +1

        #defensive coding to ensure we have the fields in the inspection documents
        if 'Latitude' in document.keys():
            if 'Longitude' in document.keys():
                if 'Address' in document.keys():
                    if(document['Latitude'] != None and document['Longitude'] != None
                        current_location_lAT_LONG.append(float(document['Latitude']))
                        current_location_lAT_LONG.append(float(document['Longitude']))
                        list_of_lAT_LONG_pairs.append(current_location_lAT_LONG)

    results = es.scroll(scroll_id = sid, scroll = '2m')
    sid = results['_scroll_id']                                   #Changing the scroll-i
    scroll_size = len(results['hits']['hits'])

chicago_map.add_child(plugins.HeatMap(list_of_lAT_LONG_pairs, radius=15))
chicago_map
```

Out[55]: Make this Notebook Trusted to load map: File -> Trust Notebook

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In [56]:
```
# Experiment 2 Query

query = {
        'size' : 10000,
        'query': {
            'bool': {

                    'must' : [{'match' : {'Results': 'Fail'}}, {"match" : {'Risk': {"c

                            {"query_string": {
                                            "query": "Child~2",
                                            "fields": ["Facility Type","Violations","D
                                             }
                            }

                            ]
                        }
                    }
        }
results = es.search(index='food_inspections', body=query,scroll='1h')
```

In [57]:
```
# Experiment 2 Results

sid = results['_scroll_id']
scroll_size = results['hits']['total']
max_score = results['hits']['max_score']

print('sid = ', sid)
print('Scroll Size = ', scroll_size)
print('Max Score = ', max_score)
```

```
sid =  DnF1ZXJ5VGhlbkZldGNoCgAAAAAD1En0FmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RJ9hZsUk
40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPUSfcWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1En4FmxSTjR
3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RJ9RZsUk40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPUSf0WbFJONHdM
UGxRei1DZlFDS2hjOUZDQQAAAAAD1En6FmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RJ-RZsUk40d0xQb
FF6LUNmUUNLaGM5RkNBAAAAAAPUSfsWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1En8FmxSTjR3TFBsUX
otQ2ZRQ0toYzlGQ0E=
Scroll Size =  10970
Max Score =  7.226171
```

In [58]:
```
# Experiment 2 Heatmap

count = 0
list_of_lAT_LONG_pairs = []

while(scroll_size > 0):

    for inspection in results['hits']['hits']:
        current_location_lAT_LONG = []
        document = inspection['_source']
        count = count +1

        #defensive coding to ensure we have the fields in the inspection documents
        if 'Latitude' in document.keys():
            if 'Longitude' in document.keys():
                if 'Address' in document.keys():
                    if(document['Latitude'] != None and document['Longitude'] != None
                        current_location_lAT_LONG.append(float(document['Latitude']))
                        current_location_lAT_LONG.append(float(document['Longitude']))
```

```
                        list_of_lAT_LONG_pairs.append(current_location_lAT_LONG)

    results = es.scroll(scroll_id = sid, scroll = '2m')
    sid = results['_scroll_id']
    scroll_size = len(results['hits']['hits'])

chicago_map.add_child(plugins.HeatMap(list_of_lAT_LONG_pairs, radius=15))
chicago_map
```

Out[58]: Make this Notebook Trusted to load map: File -> Trust Notebook

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In [59]:
```
# Experiment 3 Query
query = {
        'size' : 10000,
        'query': {
            'bool': {
                    'must' : [{'match' : {'Results': 'Fail'}}, {"match" : {'Risk': {"c

                            {"query_string": {
                                            "query": "Child's~2",
                                            "fields": ["Facility Type","Violations","D
                                             }
                            }

                            ]
                    }
                }
        }
results = es.search(index='food_inspections', body=query,scroll='1h')
```

In [60]:
```
# Experiment 3 Results
sid = results['_scroll_id']
scroll_size = results['hits']['total']
max_score = results['hits']['max_score']

print('sid = ', sid)
print('Scroll Size = ', scroll_size)
print('Max Score = ', max_score)
```

```
sid =  DnF1ZXJ5VGhlbkZldGNoCgAAAAAD1EoDFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RKBxZsUk
40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPUSgQWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1EoFFmxSTjR
3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RKCBZsUk40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPUSgYWbFJONHdM
UGxRei1DZlFDS2hjOUZDQQAAAAAD1EoLFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RKCRZsUk40d0xQb
FF6LUNmUUNLaGM5RkNBAAAAAAPUSgoWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1EoMFmxSTjR3TFBsUX
otQ2ZRQ0toYzlGQ0E=
Scroll Size =  212
Max Score =  8.618152
```

In [61]:

```python
# Experiment 3 Heatmap

count = 0
list_of_lAT_LONG_pairs = []

while(scroll_size > 0):

    for inspection in results['hits']['hits']:
        current_location_lAT_LONG = []
        document = inspection['_source']
        count = count +1

        #defensive coding to ensure we have the fields in the inspection documents
        if 'Latitude' in document.keys():
            if 'Longitude' in document.keys():
                if 'Address' in document.keys():
                    if(document['Latitude'] != None and document['Longitude'] != None
                        current_location_lAT_LONG.append(float(document['Latitude']))
                        current_location_lAT_LONG.append(float(document['Longitude']))
                        list_of_lAT_LONG_pairs.append(current_location_lAT_LONG)

    results = es.scroll(scroll_id = sid, scroll = '2m')
    sid = results['_scroll_id']
    scroll_size = len(results['hits']['hits'])

chicago_map.add_child(plugins.HeatMap(list_of_lAT_LONG_pairs, radius=15))
chicago_map
```

Out[61]: Make this Notebook Trusted to load map: File -> Trust Notebook

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The results vary greatly from the previous experiment due to the fuzziness parameter staying at 2. The length of "Child" is 5, so allowing for 2 edits on the second experiment is hardly narrowing at all.

In [62]:
```
df_top_frequent_violators.head()
```

Out[62]:

	Inspection ID	DBA Name	AKA Name	License #	Facility Type	Risk	Address	City	State	Zip	I
1	1319663	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	2215472.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0	0
2	1229713	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	3793.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0	0
3	1515476	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	2215472.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0	1
4	1229852	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	1194190.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0	0
5	1386187	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	2215472.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0	0

In [63]:
```
# column from Experiment 4, frequency of 'DBA Name'

dba_freq =  pd.DataFrame(df_top_frequent_violators['DBA Name'].value_counts().reset_ir
print(dba_freq)
```

```
                                                  index  num_violations
0                      BUSY BUMBLE BEE ACADEMY DAYCARE               9
1                     BOTTLES TO BOOKS LEARNING CENTER               8
2                A CHILD'S WORLD EARLY LEARNING CENTER               7
3                        AMAZING GRACE DAYCARE CENTER               7
4                       KIDS R FIRST LEARNING ACADEMY               6
5       Little People's Day Care & Kindergarten, Inc.               6
6                        LITTLE KIDS VILLAGE LEARNING               6
7                               LINCOLN KING DAY CARE               6
8   THE WORLD IS YOUR'S CHILD CARE & LEARNING CENT...               6
9                           JELLYBEAN LEARNING CENTER               6
10                      EARLY CHILDHOOD EDUCARE CENTER               6
11                   DISCOVERY LEARNING ACADEMY, INC.               6
12                        COMMONWEALTH DAYCARE CENTER               6
13                          FIRMAN COMMUNITY SERVICES               6
14                                KENYATTA'S DAYCARE               5
15             THE CRYSTAL PALACE EARLY LITERACY ZONE               5
16                     MONTESSORI ACDY. INFT/TOD. CNT               5
17                   MOLADE' CHILD DEVELOPMENT CENTER               5
18            LAKE & PULASKI CHILD DEVELOPMENT CENTER               5
19                       EZZARD CHARLES DAYCARE CENTER               5
20                        GREATER INSTITUTE AME CHURCH               5
21                                 GRANT DAY CARE INC               5
22                                    CENTRO INFANTIL               5
23                                            ANGELS               5
24                       ADA S MCKINLEY MAGGIE DRUMMON               5
25                      THE EDSEL ALBERT AMMONS NURSER               5
```

In [64]:

```
# Count # of Licences by 'DBA Name'

a = pd.DataFrame(df_top_frequent_violators[['DBA Name', 'License #']].value_counts().r
license_count = a['DBA Name'].value_counts().reset_index(name='num_licenses')
#print(type(license_count['counts']))
print(license_count)
```

```
                                            index  num_licenses
0                          JELLYBEAN LEARNING CENTER             4
1                          FIRMAN COMMUNITY SERVICES             4
2                      EARLY CHILDHOOD EDUCARE CENTER             3
3                      MONTESSORI ACDY. INFT/TOD. CNT             3
4                                   CENTRO INFANTIL             3
5                                 KENYATTA'S DAYCARE             3
6                     BUSY BUMBLE BEE ACADEMY DAYCARE             3
7       Little People's Day Care & Kindergarten, Inc.             2
8                    DISCOVERY LEARNING ACADEMY, INC.             2
9                                              ANGELS             2
10            LAKE & PULASKI CHILD DEVELOPMENT CENTER             2
11                       LITTLE KIDS VILLAGE LEARNING             2
12                       GREATER INSTITUTE AME CHURCH             2
13                      KIDS R FIRST LEARNING ACADEMY             2
14                       AMAZING GRACE DAYCARE CENTER             2
15             THE CRYSTAL PALACE EARLY LITERACY ZONE             2
16                      ADA S MCKINLEY MAGGIE DRUMMON             2
17                   BOTTLES TO BOOKS LEARNING CENTER             2
18                      EZZARD CHARLES DAYCARE CENTER             2
19              A CHILD'S WORLD EARLY LEARNING CENTER             2
20  THE WORLD IS YOUR'S CHILD CARE & LEARNING CENT...             2
21                              LINCOLN KING DAY CARE             1
22                   MOLADE' CHILD DEVELOPMENT CENTER             1
23                     THE EDSEL ALBERT AMMONS NURSER             1
24                                 GRANT DAY CARE INC             1
25                        COMMONWEALTH DAYCARE CENTER             1
```

In [65]:

```
dbaname_violations_licenses = pd.merge(dba_freq, license_count, on='index')
print(dbaname_violations_licenses)
```

```
                                                index  num_violations  \
0                     BUSY BUMBLE BEE ACADEMY DAYCARE               9
1                    BOTTLES TO BOOKS LEARNING CENTER               8
2               A CHILD'S WORLD EARLY LEARNING CENTER               7
3                       AMAZING GRACE DAYCARE CENTER               7
4                      KIDS R FIRST LEARNING ACADEMY               6
5       Little People's Day Care & Kindergarten, Inc.               6
6                       LITTLE KIDS VILLAGE LEARNING               6
7                              LINCOLN KING DAY CARE               6
8   THE WORLD IS YOUR'S CHILD CARE & LEARNING CENT...               6
9                          JELLYBEAN LEARNING CENTER               6
10                     EARLY CHILDHOOD EDUCARE CENTER               6
11                  DISCOVERY LEARNING ACADEMY, INC.               6
12                       COMMONWEALTH DAYCARE CENTER               6
13                         FIRMAN COMMUNITY SERVICES               6
14                                KENYATTA'S DAYCARE               5
15             THE CRYSTAL PALACE EARLY LITERACY ZONE               5
16                    MONTESSORI ACDY. INFT/TOD. CNT               5
17                  MOLADE' CHILD DEVELOPMENT CENTER               5
18            LAKE & PULASKI CHILD DEVELOPMENT CENTER               5
19                      EZZARD CHARLES DAYCARE CENTER               5
20                       GREATER INSTITUTE AME CHURCH               5
21                                 GRANT DAY CARE INC               5
22                                    CENTRO INFANTIL               5
23                                            ANGELS               5
24                      ADA S MCKINLEY MAGGIE DRUMMON               5
25                     THE EDSEL ALBERT AMMONS NURSER               5

    num_licenses
0              3
1              2
2              2
3              2
4              2
5              2
6              2
7              1
8              2
9              4
10             3
11             2
12             1
13             4
14             3
15             2
16             3
17             1
18             2
19             2
20             2
21             1
22             3
23             2
24             2
25             1
```

In [77]:
```
dbaname_violations_3ormorelicenses = dbaname_violations_licenses[dbaname_violations_li
print(dbaname_violations_3ormorelicenses)
```

```
                            index  num_violations  num_licenses
0   BUSY BUMBLE BEE ACADEMY DAYCARE               9             3
9         JELLYBEAN LEARNING CENTER               6             4
10   EARLY CHILDHOOD EDUCARE CENTER               6             3
13        FIRMAN COMMUNITY SERVICES               6             4
14               KENYATTA'S DAYCARE               5             3
16   MONTESSORI ACDY. INFT/TOD. CNT               5             3
22                  CENTRO INFANTIL               5             3
```

In [66]:
```
df_top_frequent_violators.head()
```

Out[66]:

	Inspection ID	DBA Name	AKA Name	License #	Facility Type	Risk	Address	City	State	Zip	I
1	1319663	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	2215472.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0	0
2	1229713	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	3793.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0	0
3	1515476	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	2215472.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0	1
4	1229852	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	1194190.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0	0
5	1386187	BUSY BUMBLE BEE ACADEMY DAYCARE	BUSY BUMBLE BEE ACADEMY DAYCARE	2215472.0	Daycare (2 - 6 Years)	Risk 1 (High)	6450 S COTTAGE GROVE AVE	CHICAGO	IL	60637.0	0

In [69]:
```
print(df_top_frequent_violators[['Latitude', 'Longitude']])
```

```
      Latitude  Longitude
1    41.777092 -87.606004
2    41.777092 -87.606004
3    41.777092 -87.606004
4    41.777092 -87.606004
5    41.777092 -87.606004
..         ...        ...
147  41.756551 -87.610690
148  41.756551 -87.610690
149  41.756551 -87.610690
150  41.756551 -87.610690
151  41.756551 -87.610690

[151 rows x 2 columns]
```

In [79]:

```
heatmap_dba_3ormorelicenses = df_top_frequent_violators.merge(dbaname_violations_3ormo
heatmap_dba_3ormorelicenses = heatmap_dba_3ormorelicenses[['DBA Name', 'Latitude', 'Lo
print(heatmap_dba_3ormorelicenses)
```

```
                          DBA Name   Latitude  Longitude
0   BUSY BUMBLE BEE ACADEMY DAYCARE  41.777092 -87.606004
1   BUSY BUMBLE BEE ACADEMY DAYCARE  41.777092 -87.606004
2   BUSY BUMBLE BEE ACADEMY DAYCARE  41.777092 -87.606004
3   BUSY BUMBLE BEE ACADEMY DAYCARE  41.777092 -87.606004
4   BUSY BUMBLE BEE ACADEMY DAYCARE  41.777092 -87.606004
5   BUSY BUMBLE BEE ACADEMY DAYCARE  41.777092 -87.606004
6   BUSY BUMBLE BEE ACADEMY DAYCARE  41.777092 -87.606004
7   BUSY BUMBLE BEE ACADEMY DAYCARE  41.777092 -87.606004
8   BUSY BUMBLE BEE ACADEMY DAYCARE  41.777092 -87.606004
9    EARLY CHILDHOOD EDUCARE CENTER  41.802458 -87.624433
10   EARLY CHILDHOOD EDUCARE CENTER  41.802458 -87.624433
11   EARLY CHILDHOOD EDUCARE CENTER  41.802458 -87.624433
12   EARLY CHILDHOOD EDUCARE CENTER  41.802458 -87.624433
13   EARLY CHILDHOOD EDUCARE CENTER  41.802458 -87.624433
14   EARLY CHILDHOOD EDUCARE CENTER  41.802458 -87.624433
15        FIRMAN COMMUNITY SERVICES  41.809097 -87.627599
16        FIRMAN COMMUNITY SERVICES  41.805367 -87.616633
17        FIRMAN COMMUNITY SERVICES  41.809097 -87.627599
18        FIRMAN COMMUNITY SERVICES  41.809097 -87.627599
19        FIRMAN COMMUNITY SERVICES  41.796235 -87.630405
20        FIRMAN COMMUNITY SERVICES  41.805367 -87.616633
21        JELLYBEAN LEARNING CENTER  41.765802 -87.616183
22        JELLYBEAN LEARNING CENTER  41.765802 -87.616183
23        JELLYBEAN LEARNING CENTER  41.765802 -87.616183
24        JELLYBEAN LEARNING CENTER  41.765802 -87.616183
25        JELLYBEAN LEARNING CENTER  41.765802 -87.616183
26        JELLYBEAN LEARNING CENTER  41.739343 -87.663008
27                  CENTRO INFANTIL  41.902822 -87.695990
28                  CENTRO INFANTIL  41.902822 -87.695990
29                  CENTRO INFANTIL  41.902822 -87.695990
30                  CENTRO INFANTIL  41.902822 -87.695990
31                  CENTRO INFANTIL  41.902822 -87.695990
32               KENYATTA'S DAYCARE  41.759085 -87.567448
33               KENYATTA'S DAYCARE  41.759085 -87.567448
34               KENYATTA'S DAYCARE  41.759085 -87.567448
35               KENYATTA'S DAYCARE  41.759085 -87.567448
36               KENYATTA'S DAYCARE  41.759085 -87.567448
37   MONTESSORI ACDY. INFT/TOD. CNT  41.707740 -87.643003
38   MONTESSORI ACDY. INFT/TOD. CNT  41.707740 -87.643003
39   MONTESSORI ACDY. INFT/TOD. CNT  41.707740 -87.643003
40   MONTESSORI ACDY. INFT/TOD. CNT  41.707740 -87.643003
41   MONTESSORI ACDY. INFT/TOD. CNT  41.707740 -87.643003
```

In [80]:
```
heatmap_dba_3ormorelicenses_ll = list(zip(heatmap_dba_3ormorelicenses['Latitude'], hea
```

In [81]:
```
chicago_map.add_child(plugins.HeatMap(heatmap_dba_3ormorelicenses_ll, radius=15))
chicago_map
```

Out[81]: Make this Notebook Trusted to load map: File -> Trust Notebook

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In [91]:
```
query = {
        'size' : 10000,
        'query': {
            'bool': {
                    'must' : [{'match' : {'Results': 'Fail'}}, {"match" : {'Risk': {"c

                            {"query_string": {
                                            "query": "((*Children*) AND (*MICE DROPPIN
                                            "fields": ["Facility Type","Violations","D
                                             }
                            }

                            ]
                    }
                }
        }
results = es.search(index='food_inspections', body=query,scroll='1h')

sid = results['_scroll_id']
scroll_size = results['hits']['total']
max_score = results['hits']['max_score']

print('sid = ', sid)
print('Scroll Size = ', scroll_size)
print('Max Score = ', max_score)
```

```
sid =  DnF1ZXJ5VGhlbkZldGNoCgAAAAAD1HFDFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RxRhZsUk
40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPUcUcWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1HFFFmxSTjR
3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RxRBZsUk40d0xQbFF6LUNmUUNLaGM5RkNBAAAAAAPUcUoWbFJONHdM
UGxRei1DZlFDS2hjOUZDQQAAAAAD1HFMFmxSTjR3TFBsUXotQ2ZRQ0toYzlGQ0EAAAAAA9RxSBZsUk40d0xQb
FF6LUNmUUNLaGM5RkNBAAAAAAPUcUkWbFJONHdMUGxRei1DZlFDS2hjOUZDQQAAAAAD1HFLFmxSTjR3TFBsUX
otQ2ZRQ0toYzlGQ0E=
Scroll Size =  29
Max Score =  25.657597
```

In [96]:
```
count = 0
list_of_lAT_LONG_pairs = []
```

```
while(scroll_size > 0):

    for inspection in results['hits']['hits']:                    #Iterating each  resu
        current_location_lAT_LONG = []
        document = inspection['_source']
        count = count +1

        #defensive coding to ensure we have the fields in the inspection documents
        if 'Latitude' in document.keys():
            if 'Longitude' in document.keys():
                if 'Address' in document.keys():
                    if(document['Latitude'] != None and document['Longitude'] != None
                        current_location_lAT_LONG.append(float(document['Latitude']))
                        current_location_lAT_LONG.append(float(document['Longitude']))
                        list_of_lAT_LONG_pairs.append(current_location_lAT_LONG)

    results = es.scroll(scroll_id = sid, scroll = '2m')
    sid = results['_scroll_id']                                   #Changing the scroll-i
    scroll_size = len(results['hits']['hits'])
```