# OpenStreetMap Sample Project
# Data Wrangling with MongoDB

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Map Area: Milwaukee, WI, United States

*https://s3.amazonaws.com/metro-extracts.mapzen.com/milwaukee_wisconsin.osm.bz2*

## Contents

## 1. Problems Encountered in the Map

Downloaded the Milwaukee, WI, US area OSM xml and found the following key problems:

- Inconsistent street names like Ave, Ave., Ct, D, Dr etc
- There were incorrect postcode values for some like: (“Milwaukee WI, 53222”, “1729”, “WI”)
- Inconsistent state entries: 'Milwaukee', 'WII', 'Wisconsin'
- Based on City names, it is clear that it belongs to the Milwaukee–Racine–Waukesha metropolitan area

### Inconsistent Street & State Names

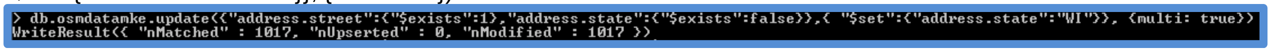
Before importing the data to Mongo DB I cleaned up the Inconsistent street names and the state entries, the logic for the same can be found in mapclean.py

There are couple of street names which has fully wrong values like “53076” which might need manual fixing based on exact knowledge using command like:

```
> db.osmdatamke.update({"address.postcode":"1729"},{"$set": {"address.postcode": "53076",
"address.city":"Richfield", "address.street":"1729 Wolf Road"}})
```

Additionally, there were multiple addressed without the state tag for address, which in this case updated to WI using the below query:

```
> db.osmdatamke.update({"address.street":{"$exists":1},"address.state":{"$exists":false}},{
"$set":{"address.state":"WI"}}, {multi: true})
```



```
> db.osmdatamke.update({"address.street":{"$exists":1},"address.state":{"$exists":false}},{ "$set":{"address.state":"WI"}}, {multi: true})
WriteResult({ "nMatched" : 1017, "nUpserted" : 0, "nModified" : 1017 })
```

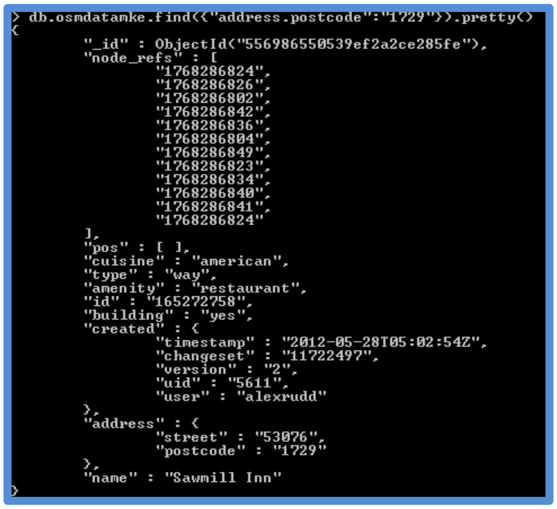
### Postal Codes

The postal codes which had issue were only 1 per type, so that was updated after importing in the Mongo DB:

```
{ "_id" : "1729", "count" : 1 }
{ "_id" : "WI", "count" : 1 }
{ "_id" : "Milwaukee WI, 53222", "count" : 1 }
```

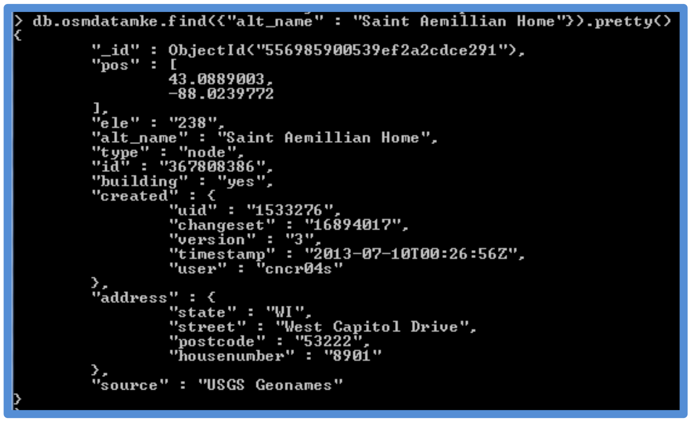
```
> db.osmdatamke.update({"address.postcode":"Milwaukee WI, 53222"},{"$set": {"address.postcode": "53222" }})
```

Before:



```
> db.osmdatamke.find({"address.postcode":"1729"}).pretty()
{
        "_id" : ObjectId("556986550539ef2a2ce285fe"),
        "node_refs" : [
                "1768286824",
                "1768286826",
                "1768286802",
                "1768286842",
                "1768286836",
                "1768286804",
                "1768286849",
                "1768286823",
                "1768286834",
                "1768286840",
                "1768286841",
                "1768286824"
        ],
        "pos" : [ ],
        "cuisine" : "american",
        "type" : "way",
        "amenity" : "restaurant",
        "id" : "165272758",
        "building" : "yes",
        "created" : {
                "timestamp" : "2012-05-28T05:02:54Z",
                "changeset" : "11722497",
                "version" : "2",
                "uid" : "5611",
                "user" : "alexrudd"
        },
        "address" : {
                "street" : "53076",
                "postcode" : "1729"
        },
        "name" : "Sawmill Inn"
}
```

After update:



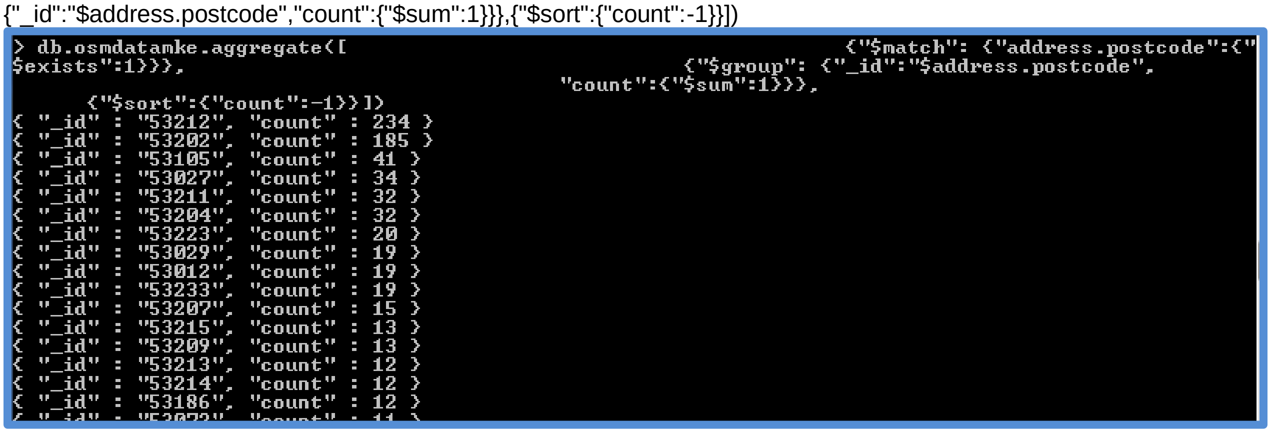
```
> db.osmdatamke.find({"alt_name" : "Saint Aemillian Home"}).pretty()
{
        "_id" : ObjectId("556985900539ef2a2cdce291"),
        "pos" : [
                43.0889003,
                -88.0239772
        ],
        "ele" : "238",
        "alt_name" : "Saint Aemillian Home",
        "type" : "node",
        "id" : "367808386",
        "building" : "yes",
        "created" : {
                "uid" : "1533276",
                "changeset" : "16894017",
                "version" : "3",
                "timestamp" : "2013-07-10T00:26:56Z",
                "user" : "cncr04s"
        },
        "address" : {
                "state" : "WI",
                "street" : "West Capitol Drive",
                "postcode" : "53222",
                "housenumber" : "8901"
        },
        "source" : "USGS Geonames"
}
```

The 9-Digit postal codes were left as-is.

### # Sort postcodes by count, descending

The top postal codes seem to be fine and part of the greater Milwaukee area.

```
> db.osmdatamke.aggregate([{"$match": {"address.postcode":{"$exists":1}}},{"$group":
{"_id":"$address.postcode","count":{"$sum":1}}},{"$sort":{"count":-1}}])
```



```
> db.osmdatamke.aggregate([                                                              {"$match": {"address.postcode":{"
$exists":1}}},                                                   {"$group": {"_id":"$address.postcode",
                                                         "count":{"$sum":1}}},
      {"$sort":{"count":-1}}])
{ "_id" : "53212", "count" : 234 }
{ "_id" : "53202", "count" : 185 }
{ "_id" : "53105", "count" : 41 }
{ "_id" : "53027", "count" : 34 }
{ "_id" : "53211", "count" : 32 }
{ "_id" : "53204", "count" : 32 }
{ "_id" : "53223", "count" : 20 }
{ "_id" : "53029", "count" : 19 }
{ "_id" : "53012", "count" : 19 }
{ "_id" : "53233", "count" : 19 }
{ "_id" : "53207", "count" : 15 }
{ "_id" : "53215", "count" : 13 }
{ "_id" : "53209", "count" : 13 }
{ "_id" : "53213", "count" : 12 }
{ "_id" : "53214", "count" : 12 }
{ "_id" : "53186", "count" : 12 }
{ "_id" : "53072", "count" : 11 }
```

## 2. Data Overview

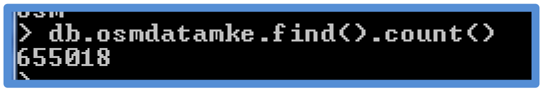
This section contains basic statistics about the dataset and the MongoDB queries used to gather them.

### File sizes

```
milwaukee_wisconsin ......... 129 MB
milwaukee_wisconsin.osm.json .... 182 MB
```

### # Number of documents

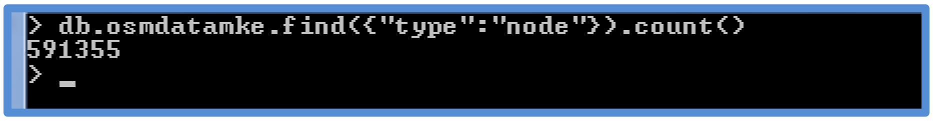
```
print(db.osmdatamke.find().count())
655018
```



```
> db.osmdatamke.find().count()
655018
```

### # Number of nodes

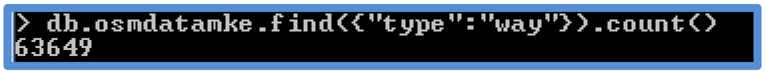
```
print(db.osmdatamke.find({"type":"node"}).count())
591355
```



```
> db.osmdatamke.find({"type":"node"}).count()
591355
> _
```

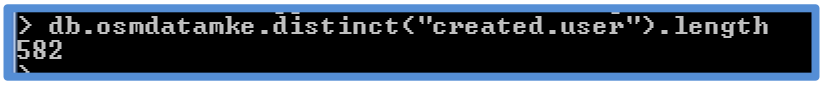
# Number of ways

```
print(db.osmdatamke.find({"type":"way"}).count())
63649
```



```
> db.osmdatamke.find({"type":"way"}).count()
63649
```

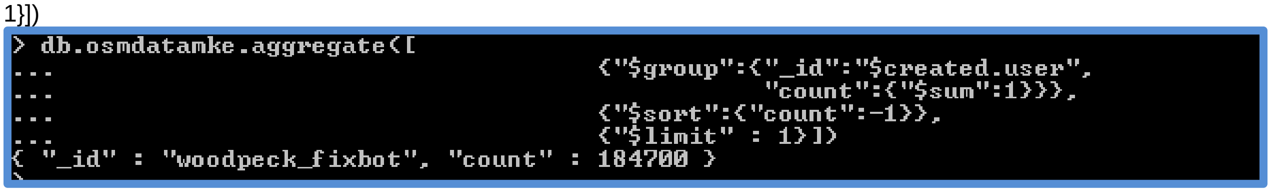
# Number of unique users



```
> db.osmdatamke.distinct("created.user").length
582
```

# Top 1 contributing user

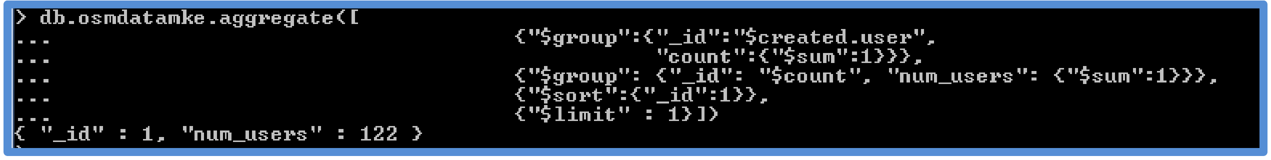
>db.osmdatamke.aggregate([{"$group":{"_id":"$created.user","count":{"$sum":1}}},{"$sort":{"count":-1}},{"$limit" : 1}])



```
> db.osmdatamke.aggregate([
...                                     {"$group":{"_id":"$created.user",
...                                                "count":{"$sum":1}}},
...                                     {"$sort":{"count":-1}},
...                                     {"$limit" : 1}])
{ "_id" : "woodpeck_fixbot", "count" : 184700 }
```

# Number of users appearing only once (having 1 post)

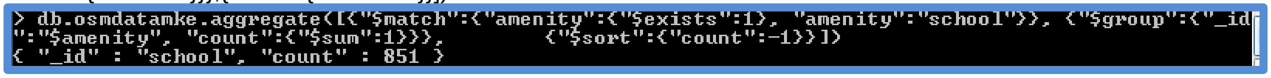
>db.osmdatamke.aggregate([{"$group":{"_id":"$created.user","count":{"$sum":1}}},{"$group": {"_id": "$count", "num_users": {"$sum":1}}},{"$sort":{"_id":1}},{"$limit" : 1}])



```
> db.osmdatamke.aggregate([
...                                     {"$group":{"_id":"$created.user",
...                                                "count":{"$sum":1}}},
...                                     {"$group": {"_id": "$count", "num_users": {"$sum":1}}},
...                                     {"$sort":{"_id":1}},
...                                     {"$limit" : 1}])
{ "_id" : 1, "num_users" : 122 }
```

# Number of schools in the area: 851

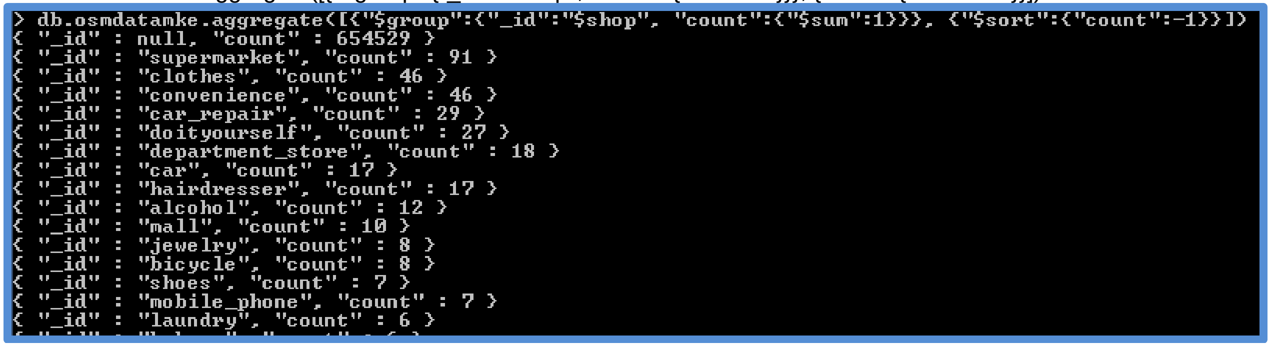
> db.osmdatamke.aggregate([{"$match":{"amenity":{"$exists":1}, "amenity":"school"}}, {"$group":{"_id":"$amenity", "count":{"$sum":1}}},{"$sort":{"count":-1}}])



```
> db.osmdatamke.aggregate([{"$match":{"amenity":{"$exists":1}, "amenity":"school"}}, {"$group":{"_id
":"$amenity", "count":{"$sum":1}}},        {"$sort":{"count":-1}}])
{ "_id" : "school", "count" : 851 }
```

# Top shops in the area:

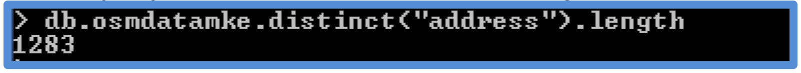
> db.osmdatamke.aggregate([{"$group":{"_id":"$shop", "count":{"$sum":1}}}, {"$sort":{"count":-1}}])



```
> db.osmdatamke.aggregate([{"$group":{"_id":"$shop", "count":{"$sum":1}}}, {"$sort":{"count":-1}}])
{ "_id" : null, "count" : 654529 }
{ "_id" : "supermarket", "count" : 91 }
{ "_id" : "clothes", "count" : 46 }
{ "_id" : "convenience", "count" : 46 }
{ "_id" : "car_repair", "count" : 29 }
{ "_id" : "doityourself", "count" : 27 }
{ "_id" : "department_store", "count" : 18 }
{ "_id" : "car", "count" : 17 }
{ "_id" : "hairdresser", "count" : 17 }
{ "_id" : "alcohol", "count" : 12 }
{ "_id" : "mall", "count" : 10 }
{ "_id" : "jewelry", "count" : 8 }
{ "_id" : "bicycle", "count" : 8 }
{ "_id" : "shoes", "count" : 7 }
{ "_id" : "mobile_phone", "count" : 7 }
{ "_id" : "laundry", "count" : 6 }
```

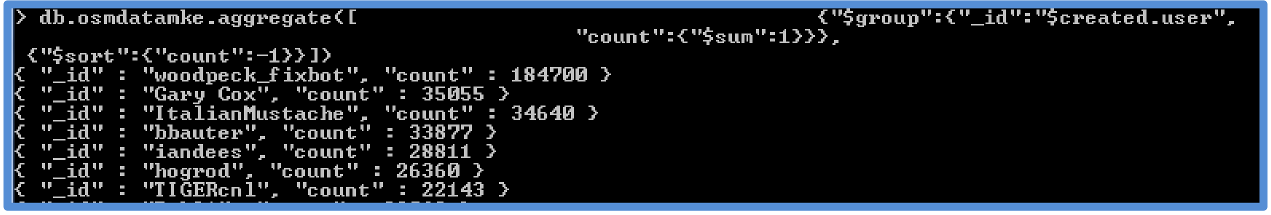
## 3. Additional Ideas

The majority  of entries are latitude and longitudes, with address related nodes being only 1283:



```
> db.osmdatamke.distinct("address").length
1283
```

And most of the node related entries are done by user: “woodpeck_fixbot” which looks to be some automated mechanism of update.

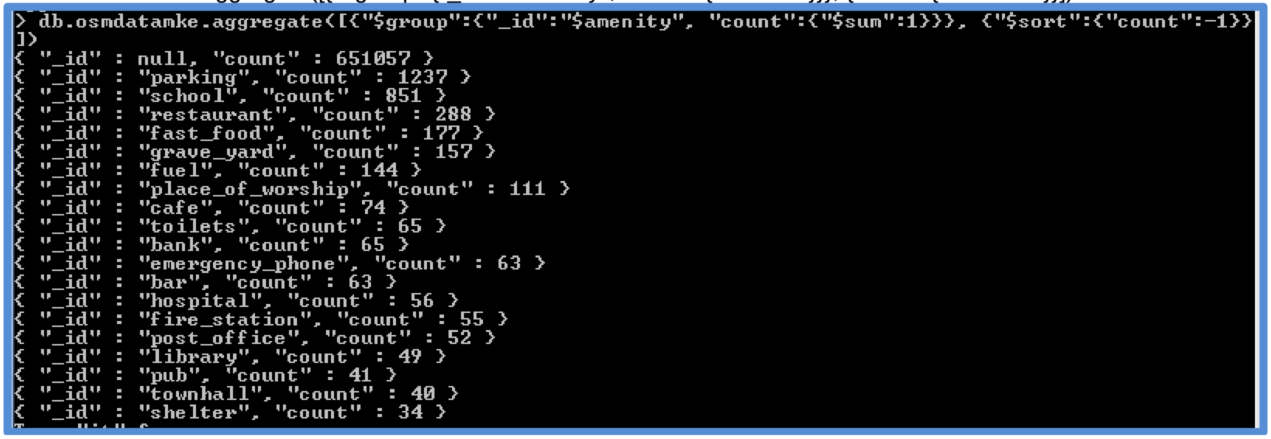


```
> db.osmdatamke.aggregate([                                    {"$group":{"_id":"$created.user",
                                                    "count":{"$sum":1}}},
 {"$sort":{"count":-1}}])
{ "_id" : "woodpeck_fixbot", "count" : 184700 }
{ "_id" : "Gary Cox", "count" : 35055 }
{ "_id" : "ItalianMustache", "count" : 34640 }
{ "_id" : "bbauter", "count" : 33877 }
{ "_id" : "iandees", "count" : 28811 }
{ "_id" : "hogrod", "count" : 26360 }
{ "_id" : "TIGERcnl", "count" : 22143 }
```

## Additional data exploration using MongoDB queries

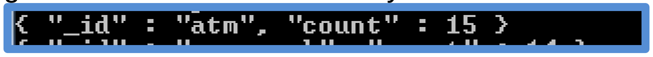
### # Top 10 appearing amenities

> db.osmdatamke.aggregate([{"$group":{"_id":"$amenity", "count":{"$sum":1}}}, {"$sort":{"count":-1}}])



```
> db.osmdatamke.aggregate([{"$group":{"_id":"$amenity", "count":{"$sum":1}}}, {"$sort":{"count":-1}}
])
{ "_id" : null, "count" : 651057 }
{ "_id" : "parking", "count" : 1237 }
{ "_id" : "school", "count" : 851 }
{ "_id" : "restaurant", "count" : 288 }
{ "_id" : "fast_food", "count" : 177 }
{ "_id" : "grave_yard", "count" : 157 }
{ "_id" : "fuel", "count" : 144 }
{ "_id" : "place_of_worship", "count" : 111 }
{ "_id" : "cafe", "count" : 74 }
{ "_id" : "toilets", "count" : 65 }
{ "_id" : "bank", "count" : 65 }
{ "_id" : "emergency_phone", "count" : 63 }
{ "_id" : "bar", "count" : 63 }
{ "_id" : "hospital", "count" : 56 }
{ "_id" : "fire_station", "count" : 55 }
{ "_id" : "post_office", "count" : 52 }
{ "_id" : "library", "count" : 49 }
{ "_id" : "pub", "count" : 41 }
{ "_id" : "townhall", "count" : 40 }
{ "_id" : "shelter", "count" : 34 }
```

The other thing which is evident for future update of this map is that ATMs in the whole of greater Milwaukee area is only shown as 15:

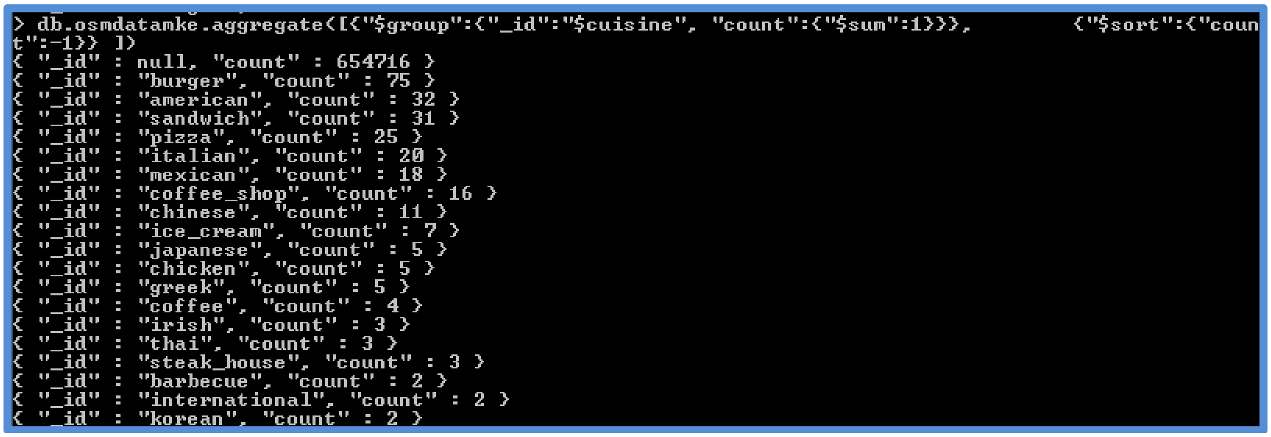


```
{ "_id" : "atm", "count" : 15 }
```

This surely is not correct and indicates scope for further improvement in the OSM data that we can contribute.

# Most popular cuisines

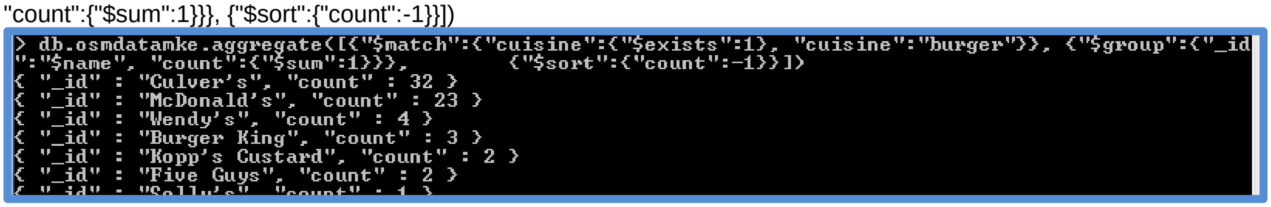
> db.osmdatamke.aggregate([{"$match":{"cuisine":{"$exists":1}}}, {"$group":{"_id":"$name", "count":{"$sum":1}}}, {"$sort":{"count":-1}}])



```
> db.osmdatamke.aggregate([{"$group":{"_id":"$cuisine", "count":{"$sum":1}}},         {"$sort":{"coun
t":-1}} ])
{ "_id" : null, "count" : 654716 }
{ "_id" : "burger", "count" : 75 }
{ "_id" : "american", "count" : 32 }
{ "_id" : "sandwich", "count" : 31 }
{ "_id" : "pizza", "count" : 25 }
{ "_id" : "italian", "count" : 20 }
{ "_id" : "mexican", "count" : 18 }
{ "_id" : "coffee_shop", "count" : 16 }
{ "_id" : "chinese", "count" : 11 }
{ "_id" : "ice_cream", "count" : 7 }
{ "_id" : "japanese", "count" : 5 }
{ "_id" : "chicken", "count" : 5 }
{ "_id" : "greek", "count" : 5 }
{ "_id" : "coffee", "count" : 4 }
{ "_id" : "irish", "count" : 3 }
{ "_id" : "thai", "count" : 3 }
{ "_id" : "steak_house", "count" : 3 }
{ "_id" : "barbecue", "count" : 2 }
{ "_id" : "international", "count" : 2 }
{ "_id" : "korean", "count" : 2 }
```

Fast food seems to be the most common cuisine and also surprising to note that **"Culver's"** Burger joint has the largest presence in the Milwaukee area.

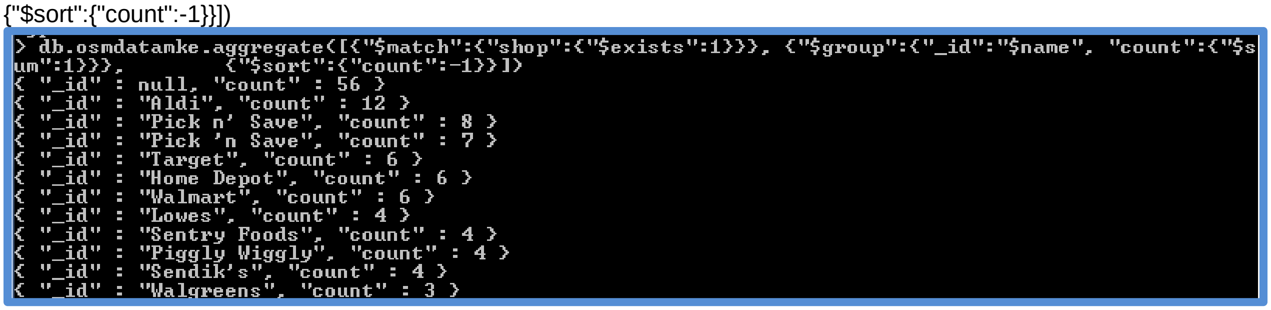
> db.osmdatamke.aggregate([{"$match":{"cuisine":{"$exists":1}, "cuisine":"burger"}}, {"$group":{"_id":"$name", "count":{"$sum":1}}}, {"$sort":{"count":-1}}])



```
> db.osmdatamke.aggregate([{"$match":{"cuisine":{"$exists":1}, "cuisine":"burger"}}, {"$group":{"_id
":"$name", "count":{"$sum":1}}},         {"$sort":{"count":-1}}])
{ "_id" : "Culver's", "count" : 32 }
{ "_id" : "McDonald's", "count" : 23 }
{ "_id" : "Wendy's", "count" : 4 }
{ "_id" : "Burger King", "count" : 3 }
{ "_id" : "Kopp's Custard", "count" : 2 }
{ "_id" : "Five Guys", "count" : 2 }
{ "_id" : "Sally's", "count" : 1 }
```

# Top shops in the area

> db.osmdatamke.aggregate([{"$match":{"shop":{"$exists":1}}}, {"$group":{"_id":"$name", "count":{"$sum":1}}}, {"$sort":{"count":-1}}])



```
> db.osmdatamke.aggregate([{"$match":{"shop":{"$exists":1}}}, {"$group":{"_id":"$name", "count":{"$s
um":1}}},         {"$sort":{"count":-1}}])
{ "_id" : null, "count" : 56 }
{ "_id" : "Aldi", "count" : 12 }
{ "_id" : "Pick n' Save", "count" : 8 }
{ "_id" : "Pick 'n Save", "count" : 7 }
{ "_id" : "Target", "count" : 6 }
{ "_id" : "Home Depot", "count" : 6 }
{ "_id" : "Walmart", "count" : 6 }
{ "_id" : "Lowes", "count" : 4 }
{ "_id" : "Sentry Foods", "count" : 4 }
{ "_id" : "Piggly Wiggly", "count" : 4 }
{ "_id" : "Sendik's", "count" : 4 }
{ "_id" : "Walgreens", "count" : 3 }
```

## Conclusion

After this review of the data it is my understanding that the region covered for greater Milwaukee area is quite accurate. There is definitely scope for much more improvement; more importantly utility related amenities like ATMS seems to be to less for such a large area and that could be easily updated with help of information from banks and their sites or with screen scraping. Same seems to be the case shops which look like grossly under updated, and this something which is most searched for, this could be easily crowdsourced using GPS info and user mobiles, by incentivizing for updates.