Data - Lifeline of the Modern World

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Introduction - Data is an integral part of modern world

Role big data plays in today’s world

How big data can make an impact in the future

Tools to store, analyze, and visualize big data

My big data project to analyze social media data
Types of Data

**Communication**: phones-calls, emails, satellite-transmission, internet

**Transportation**: Flight-status, vehicle/plane-location, airport-queue, traffic-condition, passenger-count, parking-meters

**Public Safety/Health**: Police, ambulance, crime-data, diseases-incidences, hospital-location, vaccination-records

**Environment**: noise, CO2 humidity, temperature, air-pressure, air-quality, water-quality, rain-gauges, ozone-concentration

**Public Records**: census parcels, population, tax-records, birth/death/marriage records
Who is producing Big Data?

Social media
Twitter, Instagram, Facebook, WhatsApp, Youtube, ...

Scientific Data
Satellite Imagery, Health metrics, Space observations
Who is producing Big Data?

Modern ‘Live’ Devices (Internet of Things)

Mobile phones, Smart meters, Weather sensors, In-built car sensors

Corporations

Financial transactions, Sales
Data Explosion in Social Media

By 2020!!

30 Billion Mobile Devices
40 Trillion Gigabytes of Data
10 Million mobile apps
All for 8 Billion people
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What Big Data can be used for in the Future

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Role Big Data Plays in Today’s World

● Transportation
  ○ Checking flight status, identifying plane location, finding traffic conditions

● Public Safety
  ○ Police Stations, Fire Stations, and Surveillance all use data coming from different sources and make real-time decisions for public safety
Role Big Data Plays in Today’s World

- Energy Usage
  - Electricity, Gas, and Smart meters produce large volume of data that is analyzed by utility companies for best utilization of resources.

- Weather
  - Prediction for weather (temperature, precipitation etc.) and natural disasters (tornadoes, hurricanes, tsunami) are made by analyzing large volume of scientific data coming from sensors around the world.
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How Big Data can be used in the Future

Self driven cars will communicate with each other about road conditions, traffic and gas prices data and making intelligent decision based on them.

Dating sites will find the perfect soulmate based on data available about members interest, movies they like, donation they make to charities, association with different organization etc. ;)

Better healthcare management

Chronic disease like diabetes and high blood pressure patients will be wearing devices that will be constantly sending their health related data to doctors office so they can make appropriate adjustments
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Storing Big Data

Distributed file systems

Hadoop, cloud data storage (S3, azure blob storage)

Distributed Data Management systems

Elasticsearch, CouchDB, DynamoDB
An example of analyzing big data stored in Elasticsearch using different techniques.

Police department wants to improve public safety by taking citizen petrol help for non-violent crimes such as vandalism.
Analyzing Big Data

Crime_incidents
{
    "Type" : "vandalism",
    "Time" : "15:30",
    "Date" : "12/31/2016",
    "Location" : {
        "Lat" : 34.0656,
        "Long" : 117.16645
    },
    "Case_solved" : "No",
    "Officer_assigned" : "James Smith"
}
Spatial analysis

- Find statistics for number of vandalism within 10 miles of city hall

```json
{
    "query": {
        "bool": {
            "must": {
                "match_all": {} 
            }
        },
        "filter": {
            "geo_distance": {
                "distance": "10miles",
                "pin.location": {
                    "lat": 40,
                    "lon": -70
                }
            }
        }
    }
}
```
Analyzing Big Data

- Filter data
  - Find all vandalism type crimes that occurs
    
    ```json
    "query": {
      "term": {
        "Type": "vandalism"
      }
    }
    ```
Analyzing Big Data

● Aggregation
  ○ Find when do vandalism crime happens most

GET /_search
{
  "query": {
    "term": {
      "Type": "vandalism"
    }
  },
  "aggs": {
    "tweets_over_time": {
      "date_histogram": {
        "field": "Time",
        "interval": "60m"
      }
    }
  }
}
Total Query

GET /_search
{
    "query": {
        "bool": {
            "must": {
                "match_all": {
                    "query": {
                        "term": {"Type": "vandalism"}
                    }
                }
            },
            "filter": {
                "geo_distance": {
                    "distance": "10mi",
                    "pin.location": {
                        "lat": 40,
                        "lon": -70
                    }
                }
            }
        }
    }
}
Visualizing Big Data

ArcGIS

Mapping tool that can use data to show trends across space

Tableau

Tool that can create charts and diagrams to display trends in data
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My Big Data Project:

Goal: To discover social pattern based on big data available in social media

Project: To see if there was a correlation between the number of tweets and scoreline during the SuperBowl game

Software used:

Storage and analysis: Elasticsearch including logstash extension
My Big Data Project:

Storage

Twitter feeds

Use Logstash plug-in in Elasticsearch to store live twitter feeds into Elasticsearch during super bowl

Filter twitter feeds based on keywords for NFL teams (patriots and falcons)

1.7 million tweets
My Big Data Project:

Analysis

Used Elasticsearch search and aggregation queries to find tweets for different teams during different time of the game.

Search Query to find certain tweets

```
GET /_search
{
  "query": {
    "term" : {"text":"patriots"}
  }
}
```

Search query to find number of tweets per quarter per team

```
```

My Big Data Project:

Diagrammtitel

- Quarter 1
- Quarter 2
- Quarter 3
- Quarter 4

Patriots
Falcons