SAPIENZA
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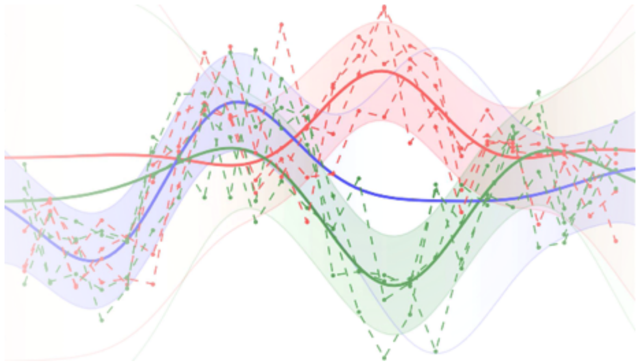
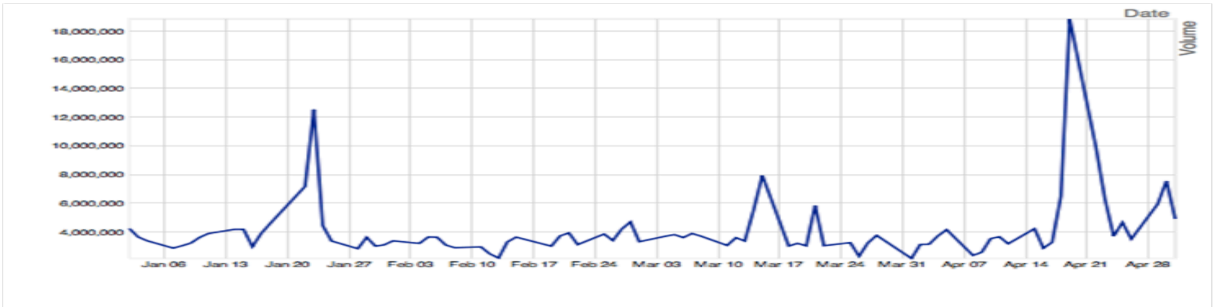


Follow the Flow.

Terms based Timeseries.

Time series

- A **time series** is a sequence of data points; typically measured at successive points in time, spaced at uniform time intervals.
- **Examples:** of time series are the daily closing value of the Dow Jones Industrial Average
- Time series are very frequently **plotted** via line charts.



Daily trading volumes of IBM (Jan-Apr 2013)

- Time series are used in **statistics**, **signal processing**, **pattern recognition**, **econometrics**, **mathematical finance**.

Parts

- Time Series are composed:
  - Time
  - Value

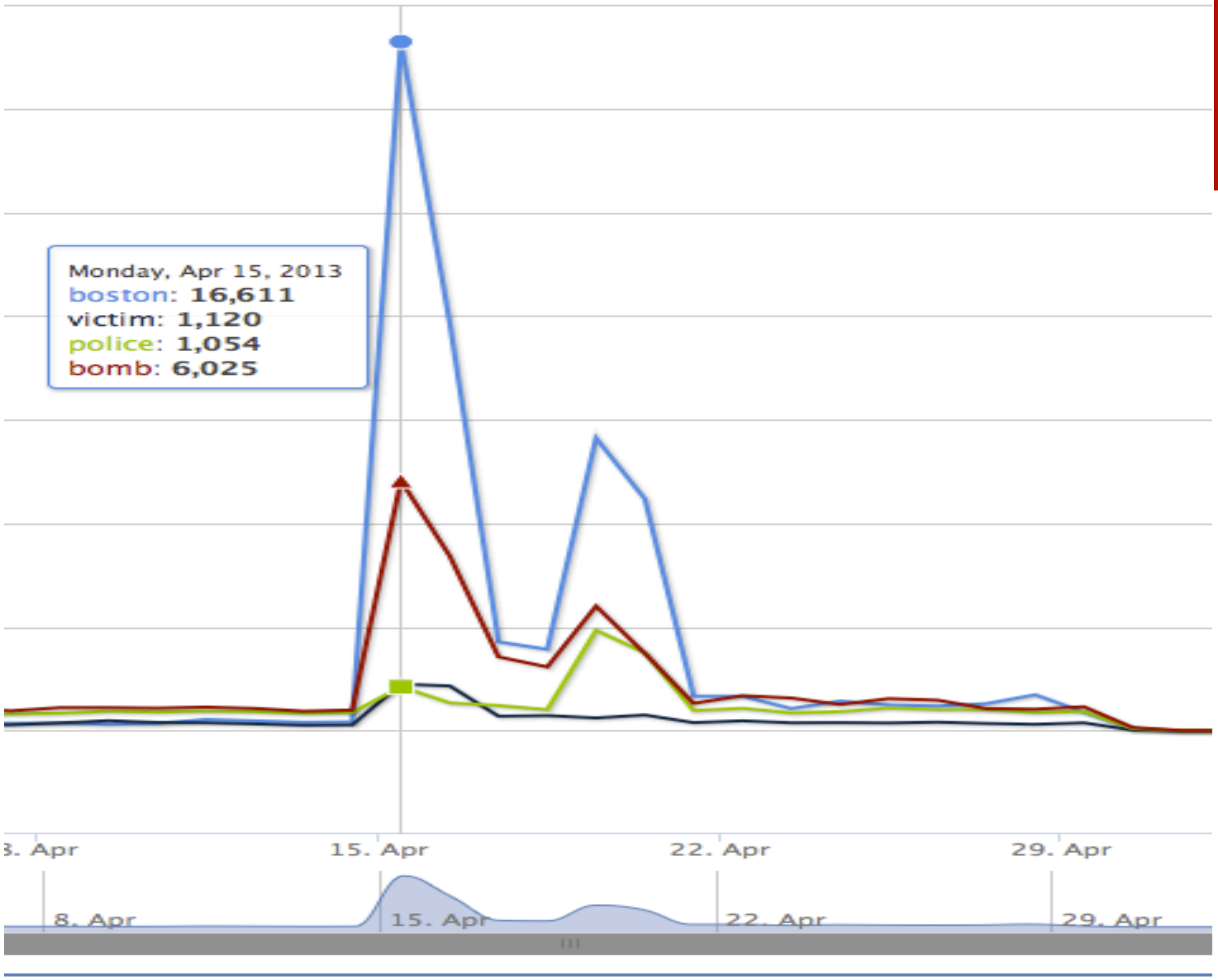
- Two values array(one for time aspect and one for data aspect) is the simplest rappresentation.

Term Time Series

- Term Time Series are time series that keep track of the number of occurences of single term over time.

- Normally are fixed interval Time Series (minutes, hour, day interval).

Term Time Example



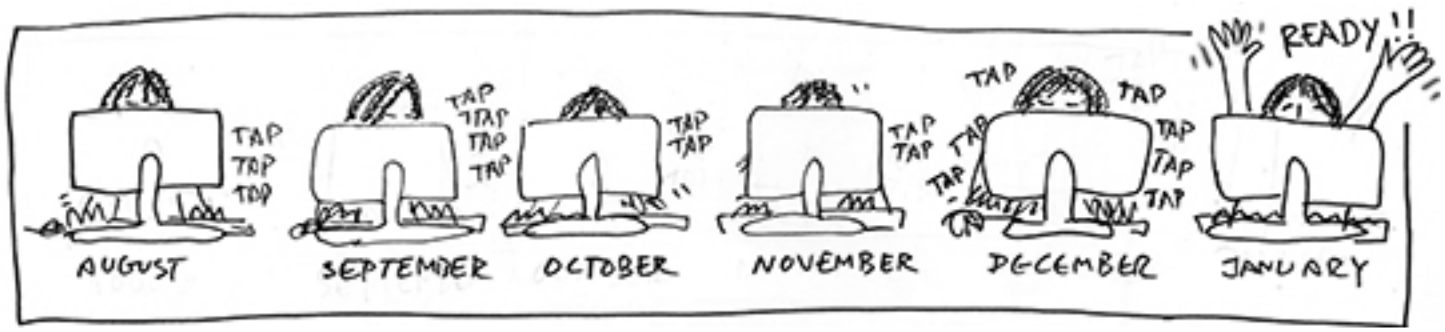
How To

- If we have a temporal aspect in a document (for example Tweets timestamp) we should count all the documents that contain that term $\boldsymbol{w}_j$ in a specific time interval $\boldsymbol{t}_i$.
- That produce the value of $\boldsymbol{w}_j$ in $\boldsymbol{t}_i$.

Class Work (1)

- Using the streaming api (Twitter4J) collect the stream that keep track of the following "target" terms:
  - Renzi
  - Grillo
  - Berlusconi
  - Di Battista
  - Meloni
- For each "target" term create (at realtime) the relative time series.
  Using 2 minutes time fixed interval.
- Design your own implementation for a time series representation.

Let’s Try?!?!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SEPTEMBER
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OCTOBER
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NOVEMBER
TAP TAP TAP TAP TAP TAP TAP
DECEMBER
READY!!
JANUARY

Class Work (2)

- Using the streaming api (Twitter4J) collect the stream that keep track of the following "target" terms:
  - Renzi
  - Grillo
  - Berlusconi
  - Di Battista
  - Meloni
- Build a Lucene index for all tweets.
- For each "target" extract from the Lucene index the relative time series.
  Fixed time interval should be chosen later.

SAX String

- To convert a Time Series to a SAX string

```
...
    int alphabetSize = 2;
    double nThreshold = 0.01;
    // instantiate classes
    NormalAlphabet na = new NormalAlphabet();
    SAXProcessor sp = new SAXProcessor();

    // data Vector
    double[] ts = {10, 20, 20, 50, 80, 10, 50, 80, 10, 5};

    // perform the discretization
    SAXRecords res = sp.ts2saxByChunking(ts, ts.length,
                              na.getCuts(alphabetSize), nThreshold);

    // print the output
    String sax = res.getSAXString("");
    System.out.println(sax);
    System.out.println(sax.matches("a+b+a*b*a*"));
...
```

Maven Artifacts

```
<dependency>
   <groupId>net.seninp</groupId>
   <artifactId>jmotif-sax</artifactId>
   <version>1.1.1</version>
</dependency>
```

Class Work (2)

- Using the streaming api (Twitter4J) collect the Public stream (1%) and get only the Italian Tweets.
- For each term create the relative time series. Using 1 minutes time (delta) fixed interval for 10 minutes.
- Discard all time series below a fixed threshold (1000 tweets)
- Convert each time series to SAX and filter it if not satisfy the regex:
  - ***a+b+a*b*a****
- Group together all terms that show the same SAX String.

Class Work (3)

- Reading Tweets from the collection.
  And Create a Lucene Index for any(sliding) window of 10 hours in the dataset.
- For each window consider terms with a minimum number of 10000 occurrences.
- create the relative time series using 1 hour time (delta) fixed interval for 10 hours.
- Convert each time series to SAX and filter it if not satisfy the regex:
  - ***a+b+a*b*a****
- Group together all terms that show the same SAX String.

List Files

```
File folder = new File(dirPath);


File[] listOfFiles = folder.listFiles();

for (File file : listOfFiles) {

      if (file.isFile()) {

            System.out.println(file.getName());
            // DO SOMETHING;
      }
}
```

Reading File

```
FileInputStream fstream =
                        new FileInputStream(file);
GZIPInputStream  gzStream =
                        new GZIPInputStream(fstream);
InputStreamReader isr = new InputStreamReader(gzStream)
BufferedReader br =
                        new BufferedReader(isr );

        String line;

        //Read File Line By Line
        while ((line = br.readLine()) != null) {
            // Print the content on the console
            System.out.println(line);
        }

        br.close();
```

Reading Index Lexicon

```
Fields fields = MultiFields.getFields(index);
Terms terms = fields.terms(defaultField);

TermsEnum iterator = terms.iterator(null);
BytesRef byteRef = null;
while ((byteRef = iterator.next()) != null) {
String t = new String(byteRef.bytes, byteRef.offset,
  byteRef.length);
 if ((t.length() > 2) && (t.length() < 15) &&
  StringUtils.isAlpha(t) && (iterator.docFreq() >
  minFrq)) {

      // CREATE TIMESERIES

  }
}
```

Get Stats

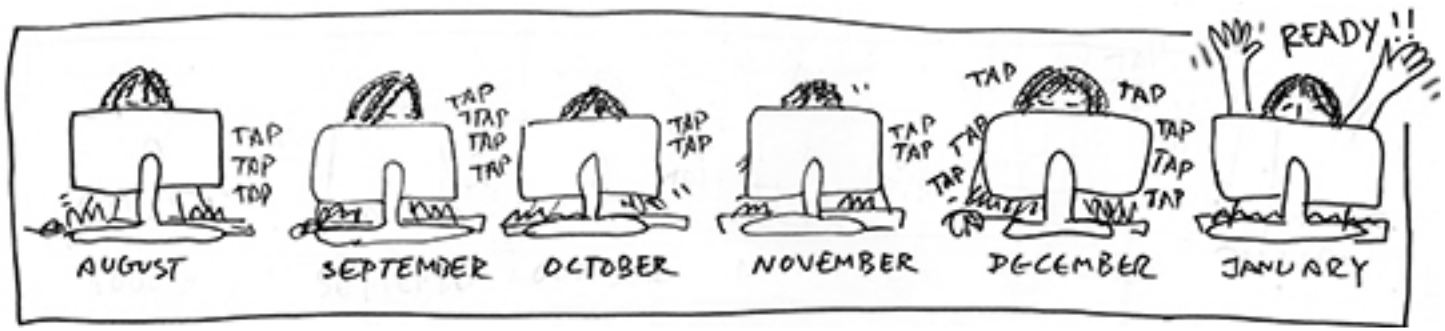
```
TotalHitCountCollector collector = new
  TotalHitCountCollector();

FieldCacheRangeFilter<Long> dateFilter =
  FieldCacheRangeFilter.newLongRange(”TIMEFIELD",
start, end, true, false);

searcher.search(myQuery, dateFilter, collector);

collector.getTotalHits();
```

Let's Try?!?!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GIT

- http://rogerdudler.github.io/git-guide/

& clone

- https://github.com/giovanni-stilo/G