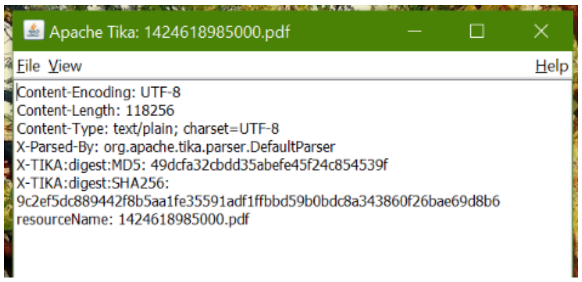
CSCI 599 – spring 2016 – Assignment 1 – Group 12

This report summarizes details all of our work on first assignment. First we shall cover each point as per task list one by one along with our results and challenges faced.

1. Download and install Apache Tika
   With the help of Tika documentation, this was easiest task of all. We downloaded entire source and built it using "mvn install" command. We were able to run tika using command line, GUI and python rest server. We also wrote small program in Java which used Tika class to detect Mime type. More information on that in Task 3.

2. Download and install D3.js
   Downloading and installing d3 was straight forward. We just downloaded d3.js and d3.min.js files and looked at rich gallery of visualization on its github page.

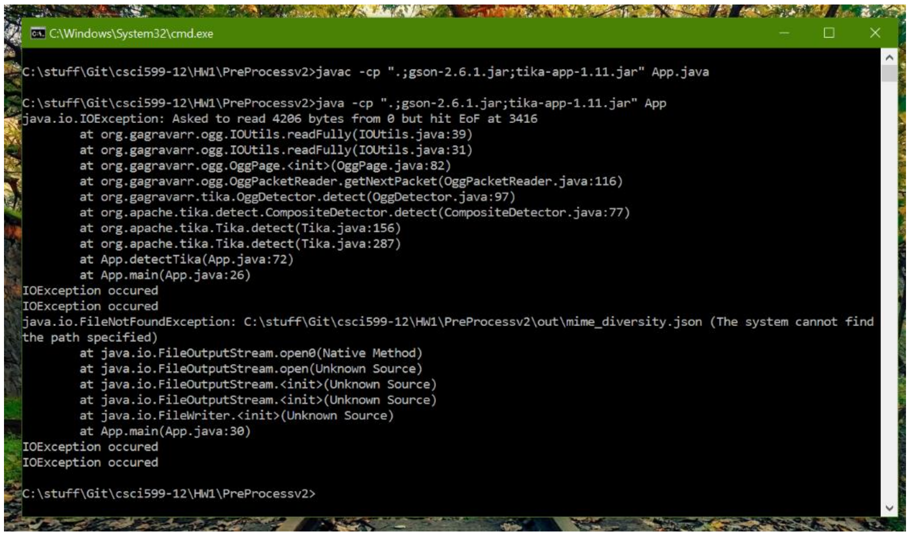
3. Download the Amazon S3-based TREC-DD-Polar data
   This one ate lot of our time initially. We faced multiple issues in downloading data, cleaning data and distributing data. First of all, we downloaded all diversity Json files from "latest-commoncrawl" bucket's main directory. Based on number of different file types and size, we chose to download "572-team1" folder to try out before we go for full download. Challenge here was that we did not know which folder contains which file types as folder hierarchy was based on crawling and had no ordering with respect to MIME types.
   After downloading, we wrote small Java program to recursively scan through folders, run tika mime detection over each file and move files based on mime types. Before running it over entire folder we downloaded, we manually ran it on few folders and found out that there was something wrong in the data and Tika was not able to detect them correctly. E.g. PDF file at S3 url crawl/572-team1/201/175/47/81/9abb360bb295e7b0e256e2ecf74d64aca7f13fca/1424618985000.pdf was being detected "text/plain" and it wasn't even opening in pdf viewer whereas most of the html



```
Content-Encoding: UTF-8
Content-Length: 118256
Content-Type: text/plain; charset=UTF-8
X-Parsed-By: org.apache.tika.parser.DefaultParser
X-TIKA:digest:MD5: 49dcfa32cbdd35abefe45f24c854539f
X-TIKA:digest:SHA256:
9c2ef5dc889442f8b5aa1fe35591adf1ffbbd59b0bdc8a343860f26bae69d8b6
resourceName: 1424618985000.pdf
```

files were detected correctly. After careful review of different file types, we found that most of the non-text type were detected incorrectly. In subsequent classes, we came to know that "latest-commoncrawl" contained data from Apache Nutch which encodes every file in cbor format which sadly Tika can't decode. We spent some time understanding cbor format and modifying our program to sort files to decode cbor before sending it to Tika. After a while we were able to decode cbor format. However, we downloaded few folders from "polar-fulldump" in parallel and found that they did not contain any cbor encoding around its data. Given the overhead of cbor format and large amount of data that we had to process, we ditched "latest-commoncrawl" and decided to download entire "polar-fulldump" data. Among three of us, we distributed 60 folders each as there were 180 folders in total.

We started batch download in the night but download went on the whole next day. Also as we did not know size distribution, one of us ended up downloading 50 GB+ data and two of us got ~7 GB and ~10 GB respectively. Two of us with lesser amount of data were quickly able to run Tika over entire data to sort the files. However, we observed that Tika was throwing IOException in determining certain files which we did not handle gracefully. We spent some time trying to



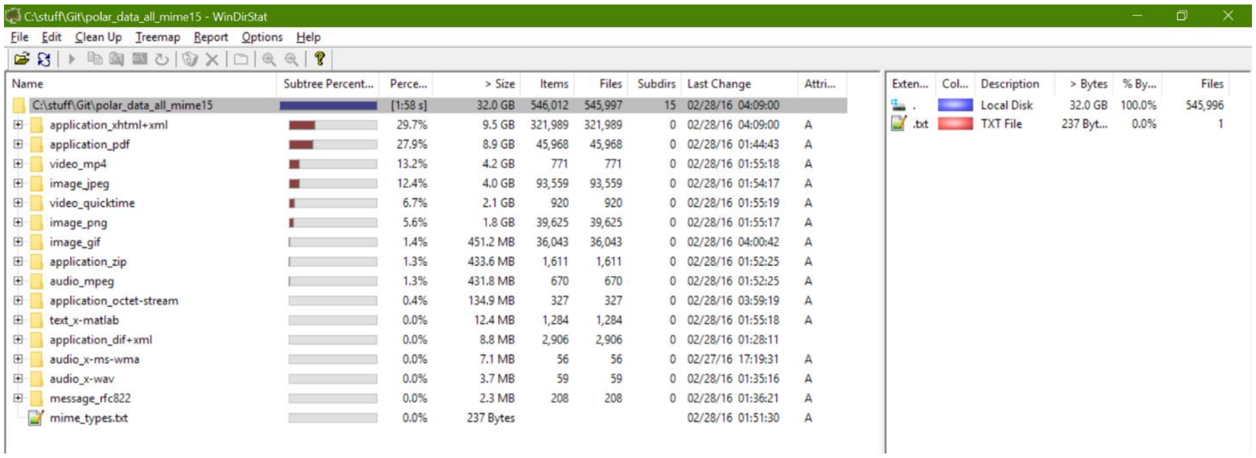
```
C:\stuff\Git\csci599-12\HW1\PreProcessv2>javac -cp ".;gson-2.6.1.jar;tika-app-1.11.jar" App.java

C:\stuff\Git\csci599-12\HW1\PreProcessv2>java -cp ".;gson-2.6.1.jar;tika-app-1.11.jar" App
java.io.IOException: Asked to read 4206 bytes from 0 but hit EoF at 3416
        at org.gagravarr.ogg.IOUtils.readFully(IOUtils.java:39)
        at org.gagravarr.ogg.IOUtils.readFully(IOUtils.java:31)
        at org.gagravarr.ogg.OggPage.<init>(OggPage.java:82)
        at org.gagravarr.ogg.OggPacketReader.getNextPacket(OggPacketReader.java:116)
        at org.gagravarr.tika.OggDetector.detect(OggDetector.java:97)
        at org.apache.tika.detect.CompositeDetector.detect(CompositeDetector.java:77)
        at org.apache.tika.Tika.detect(Tika.java:156)
        at org.apache.tika.Tika.detect(Tika.java:287)
        at App.detectTika(App.java:72)
        at App.main(App.java:26)
IOException occured
IOException occured
java.io.FileNotFoundException: C:\stuff\Git\csci599-12\HW1\PreProcessv2\out\mime_diversity.json (The system cannot find
the path specified)
        at java.io.FileOutputStream.open0(Native Method)
        at java.io.FileOutputStream.open(Unknown Source)
        at java.io.FileOutputStream.<init>(Unknown Source)
        at java.io.FileOutputStream.<init>(Unknown Source)
        at java.io.FileWriter.<init>(Unknown Source)
        at App.main(App.java:30)
IOException occured
IOException occured

C:\stuff\Git\csci599-12\HW1\PreProcessv2>
```

figure out why this was happening and tried bunch of different Tika version. This wasted our one day as we could not run the program over night over 50 GB data chunk which had halted due to same error. Next day we updated program and re-executed over remaining data. We faced some unexpected delay while running our program on OS X due to automatically created .DS_STORE files. After ignoring those files we were finally able to sort files. Although, our laptops were hanging so we had to run it over multiple iteration manually over small chunks of data.

Once, we had all the data sorted, we found that mime diversity reported on http://github.com/chrismattmann/trec-dd-polar/ was not entirely matching with mime diversity that we observed. E.g. before looking at the data, we had decided to include "xscapplication/zip" mime type for our analysis. However, we did not get even a single file detected as that type from entire "polar-fulldump" even though there were supposed to be 85 files of that type. This is probably due to evolution of Tika over time and its ability to classify correctly or incorrectly. Finally we chose 15 MIME types based on data that we had and variety of MIME type. Below screenshot shows all 15 mime type that we selected along with number of files and total size we used.



C:\stuff\Git\polar_data_all_mime15 - WinDirStat

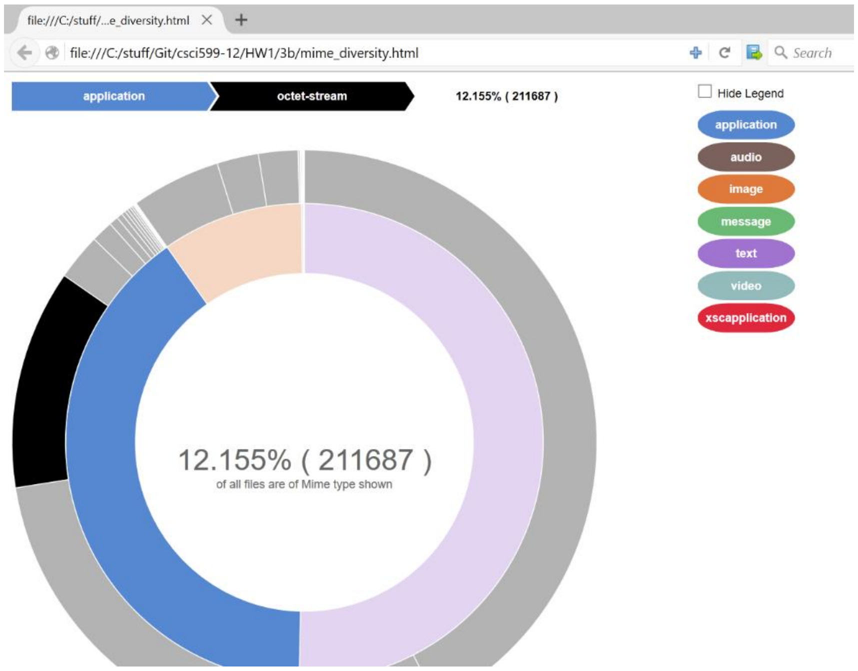
File Edit Clean Up Treemap Report Options Help

Name	Subtree Percent...	Perce...	> Size	Items	Files	Subdirs	Last Change	Attri...
C:\stuff\Git\polar_data_all_mime15		[1:58 s]	32.0 GB	546,012	545,997	15	02/28/16 04:09:00	
application_xhtml+xml		29.7%	9.5 GB	321,989	321,989	0	02/28/16 04:09:00	A
application_pdf		27.9%	8.9 GB	45,968	45,968	0	02/28/16 01:44:43	A
video_mp4		13.2%	4.2 GB	771	771	0	02/28/16 01:55:18	A
image_jpeg		12.4%	4.0 GB	93,559	93,559	0	02/28/16 01:54:17	A
video_quicktime		6.7%	2.1 GB	920	920	0	02/28/16 01:55:19	A
image_png		5.6%	1.8 GB	39,625	39,625	0	02/28/16 01:55:17	A
image_gif		1.4%	451.2 MB	36,043	36,043	0	02/28/16 04:00:42	A
application_zip		1.3%	433.6 MB	1,611	1,611	0	02/28/16 01:52:25	A
audio_mpeg		1.3%	431.8 MB	670	670	0	02/28/16 01:52:25	A
application_octet-stream		0.4%	134.9 MB	327	327	0	02/28/16 03:59:19	A
text_x-matlab		0.0%	12.4 MB	1,284	1,284	0	02/28/16 01:55:18	A
application_dif+xml		0.0%	8.8 MB	2,906	2,906	0	02/28/16 01:28:11	
audio_x-ms-wma		0.0%	7.1 MB	56	56	0	02/27/16 17:19:31	A
audio_x-wav		0.0%	3.7 MB	59	59	0	02/28/16 01:35:16	A
message_rfc822		0.0%	2.3 MB	208	208	0	02/28/16 01:36:21	A
mime_types.txt		0.0%	237 Bytes				02/28/16 01:51:30	A

Exten...	Col...	Description	> Bytes	% By...	Files
.	🟦	Local Disk	32.0 GB	100.0%	545,996
.txt	🟥	TXT File	237 Byt...	0.0%	1

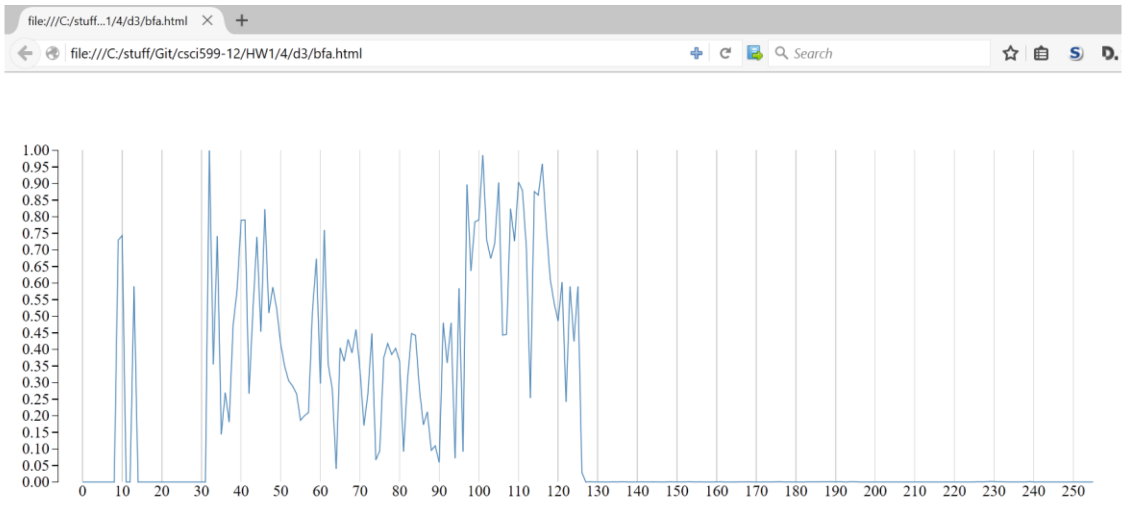
As shown in screenshot, we have chosen four types from application, three from audio, three from image, one message, one text and two video and octet stream amounting to total of 32 GB and over 500K files. Another interesting fact to point out here is that all of the files are having no extension at all which makes it harder to verify the accuracy of mime types.

Below is the screenshot of interactive Sunburst D3 chart for existing MIME diversity of the TRECDD-Polar dataset using the existing JSON breakdown from Github. We modified existing code from https://gist.github.com/kerryrodden/7090426 to match as per our requirement. It made sense to use this kind of layered pie chart instead of using single pie chart which becomes messier as there are more than 90 mime types. Even here, we can hardly see audio/message/video/xscapplication because of small number of files. We have included this chart in our submission. Screenshot is created with mouse hover over octet stream data which one can see on the top left along with its relative percentage and number of files. On the left we are showing legend for top level mime types. As we can see from the chart, majority of files belong to text/html mime type which makes sense as this is web crawl data.



4. BFA

   Below is a sample BFA fingerprint plotted as a line chart applied on 75% text/x-matlab mime types. This is just one of the example. We have submitted bfa fingerprint for all fifteen mime types over 75% of our data.



5. BFC and BFCC
6. FHT
7. Final analysis
8. Tika Similarity
9. Content Based MIME detector