Pattern Discovery Using Association Rules

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Abstract— The explosive growth of Internet has given rise to many websites which maintain large amount of user information. To utilize this information, identifying usage pattern of users is very important. Web usage mining is one of the processes of finding out this usage pattern and has many practical applications. Our paper discusses how association rules can be used to discover patterns in web usage mining. Our discussion starts with preprocessing of the given weblog, followed by clustering them and finding association rules. These rules provide knowledge that helps to improve website design, in advertising, web personalization etc.

Keywords- Weblogs; Pattern discovery; Association rules.

I. INTRODUCTION

Association rule is one of the data mining tasks which can be used to uncover relationship among data. Association rule identifies specific association among data and its techniques are generally applied to a set of transactions in a database. Since, amount of data handled is extremely large, current association rule techniques are trying to prune the search space according to support count.

Rules discovery finds common rules in the format $A \rightarrow B$, meaning that, when page A is visited in a transaction, page B will also be visited in the same transaction. These rules may have different values of the confidence and support [1].

Confidence is the percentage between the number of transactions containing both items of the rule and the number of transactions containing just the antecedent. Support is the percentage of transactions in the rule is true.

In the context of Web Usage Mining, association rules refers to set of pages which are accessed together with a minimum support value which can help in organizing Web space efficiently.

For example: Consider if 70% of the users who accessed

get/programs/courses/x.asp also accessed

get/programs/courses/y.asp, but only 30% of those who accessed get/programs/courses accessed

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get/programs/courses/y.asp, then it shows that some information in x.asp is making the clients access y.asp.

This inference helps the designers to decide on designing a link between the above two pages. The task of association rule mining has received a great deal of attention. Association rule mining is still one of the most popular pattern-discovery methods in KDD.

Hence, we would like to use association rules for pattern discovery analysis of Web Server Logs.

A. Web Server Log

Web Servers are used to record user interactions whenever any request for resources are received.

A server log is a log file automatically created and maintains a history of page requests. Information about the request, including client IP address, request date/time, page requested, HTTP code, bytes served, user agent, and referrer are typically added. These data can be combined into a single file, or separated into distinct logs, such as an access log, error log, or referrer log. However, server logs typically do not collect user-specific information [2].

But to understand the user behavior, analysis of these weblogs is a must. This analysis can help in understanding the user access patterns and can lead to grouping of resource providers, restructuring of websites, pinpointing effective advertising locations, targeting specific users for specific advertisements.

Unprocessed log are shown below:

#Fields: date time c-ip cs-username s-sitename scomputername s-ip s-port cs-method cs-uri-stem cs-uriquery sc-status time-taken cs-version cs-host cs(User-Agent) cs(Referer)

2002-04-01 00:00:10 1cust62.tnt40.chi5.da.uu.net w3svc3 bach bach.cs.depaul.edu 80 get /courses/syllabus.asp course=323-21-603&q=3&y=2002&id=671 200 156 http/1.1 www.cs.depaul.edu mozilla/4.0+(compatible;+msie+5.5;+windows+98;+win +9x+4.90;+msn+6.1;+msnbmsft;+msnmen-us;+msnc21) http://www.cs.depaul.edu/courses/syllabilist.asp depaul.edu/courses/syllabilist.asp

2002-04-01 00:00:26 ac9781e5.ipt.aol.com - w3svc3 bach bach.cs.depaul.edu 80 get /advising/default.asp -200 16 http/1.1 www.cs.depaul.edu mozilla/4.0+(compatible;+msie+5.0;+msnia;+windows+ 98;+digext)

http://www.cs.depaul.edu/news/news.asp?theid=573

2002-04-01 00:00:29 alpha1.csd.uwm.edu - w3svc3 bach bach.cs.depaul.edu 80 get /default.asp - 302 0 http/1.1www.cs.depaul.edu

mozilla/4.0+(compatible;+msie+6.0;+msn+2.5;+window s+98;+luc+user) –

A sample log file converted into database in shown below in Table I.

II. SCOPE AND APPLICATIONS

The user access log has very significant information about a Web server. A Web server access log contains a complete history of webpages accessed by clients. By analyzing these logs, it is possible to discover various kinds of knowledge, which can be applied to improve the performance of Web services.

Web usage mining has several applications and is used in the following areas:

- 1) It offers users the ability to analyze massive volume of click stream or click flow data.
- Personalization for user can be achieved by keeping track of previously accessed pages which can be used to identify the typical browsing behavior of a user and subsequently to predict desired pages.

3) By determining access behavior of users, needed links can be identified to improve the overall performance of future accesses.

Web usage patterns are used to gather business intelligence to improve customer attraction, customer retention, sales, marketing, and advertisements cross sales. Web usage mining is used in e-Learning, e-Business, e-Commerce, e-Newspapers, e-Government and Digital Libraries.

III. PROPOSED SYSTEM

We would like to propose a system which would discover interesting patterns in these weblogs. Weblogs has information about accesses to various Web pages within the Web space associated with a particular server.

In case of Web transactions, association rules capture relationships among pageviews based on navigation patterns of users.

A. Steps involved in the proposed system

Our proposed system would involve the following steps:

- 1) The input is a set of Weblogs for which we have to find association rules. We have chosen University Web server logs from www.cs.depaul.edu site
- 2) The server logs contain entries that are redundant or irrelevant for data mining tasks.
- 3) The Data cleaning process will select a subset of fields that are relevant for the task.
- 4) These selected attributes are then stored into a database.
- 5) Using a simple clustering approach these entries are divided into clusters or segmented.
- 6) Now, association rule mining is applied on these clusters, to obtain association rules having minimum support and confidence.
- 7) As a result of association rule mining, interesting patterns can be discovered and client's web usage can be evaluated.

| Т | Client IP | Date time | Method | Server IP | Port | URI Stem |
|----|-----------------|------------------------|--------|-----------------|------|--|
| no | | | | | | |
| 0 | 202.185.122.151 | 11/23/200 3 4:00:01PM | GET | 202.190.126.85 | 80 | /index.asp |
| 1 | 202.185.122.151 | 11/23/200 3 4:00:08 PM | GET | n202.190.126.85 | 80 | /index.asp |
| 2 | 210.186.180.199 | 11/23/200 3 4:00:10 PM | GET | 202.190.126.85 | 80 | /index.asp |
| 3 | 210.186.180.199 | 11/23/200 3 4:00:13 PM | GET | 202.190.126.85 | 80 | /tutor/include/style03.css |
| 4 | 210.186.180.199 | 11/23/200 3 4:00:13 PM | GET | 202.190.126.85 | 80 | /tutor/include/detectBrowser_coo kie.js |

TABLE I: A SAMPLE LOG FILE IN TABLE FORMAT.

IV. DESIGN

A. Flow Diagram:

The flowchart for pattern discovery using association rules is given in fig 1.





Each of these blocks is explained in detail as follows:

1) Obtain Web Server logs:

Web server log is a file which is created and maintained by the webserver. We are analyzing the log file of the site: <u>www.cs.depaul.edu</u>. It is a text file. The file follows the extended log file format.

2) Preprocessing the logs:

The weblog created by the webserver contains details of all requests. It contains lot of irrelevant, incomplete data. Preprocessing involves removing such data.

3) Conversion of log file to database:

The weblog cannot be directly used for data mining. The dataset is converted to a database. This involves creating a database and then importing the log file to the MySQL database table.

4) Segmenting the database:

In this step, the database is segmented into clusters depending on the support count. After this a number of small clusters are obtained. Depending on the need, these clusters can be analyzed. Clustering web usage data allows the Web master to identify groups of users with similar behaviors for which personalized versions of the Web site may be created.

5) Pattern Discovery:

The next step is pattern discovery. Once the clusters are formed they are studied to recognize patterns within the entries of the clusters.

6) Association rules:

Association rules show relationship among different items. In case of Web mining, an example of an association rule is the correlation among accesses to various web pages on a server by a given client. Such association rules are obtained in this step

7) Pattern Evaluation:

The association rules obtained in the earlier step help in establishing relationships among data items. These association rules are evaluated to understand the information they provide. The interpretations of the rules provide useful knowledge.

B. Implementation

The following diagrams illustrate the steps of implementation.



Figure 2 Welcome screen of weblog analyzer

Step 1: Weblog of University website hosted on a web server were obtained from <u>www.cs.depaul.edu</u>. There are 5061 records. The following figure3 shows the unprocessed weblog file.

| #Software: Microsoft Internet Information Services 5.0 |
|---|
| #Version: 1.0 |
| #Date: 2002-04-01 00:00:00 |
| #Fields: date time c-ip cs-username s-sitename s-computername s-ip s-port cs-method cs-uri-stem cs-uri-query sc-status t |
| 2002-04-01 00:00:10 1cust62.tnt40.chi5.da.uu.net - w3svc3 bach bach.cs.depaul.edu 80 get /courses/syllabus.asp course=32 |
| 2002-04-01 00:00:26 ac9781e5.ipt.aol.com - w3svc3 bach bach.cs.depaul.edu 80 get /advising/default.asp - 200 16 http/1.1 |
| 2002-04-01 00:00:29 alpha1.csd.uwm.edu – w3svc3 bach bach.cs.depaul.edu 80 qet /default.asp – 302 0 http/1.1 www.cs.depa |
| 2002-04-01 00:00:29 12-250-96-248.client.attbi.com – w3svc3 bach bach.cs.depaul.edu 80 get /courses/default.asp – 200 94 |
| 2002-04-01 00:00:30 w010.z064221069.chi-il.dsl.cnc.net - w3svc3 bach bach.cs.depaul.edu 80 get /default.asp - 302 0 http |
| 2002-04-01 00:00:30 alpha1.csd.uwm.edu - w3svc3 bach bach.cs.depaul.edu 80 get /news/default.asp - 200 62 http/1.1 www.c |
| 2002-04-01 00:00:30 w010.z064221069.chi-il.dsl.cnc.net - w3svc3 bach bach.cs.depaul.edu 80 get /news/default.asp - 200 6 |
| 2002-04-01 00:00:32 ac9781e5.ipt.aol.com - w3svc3 bach bach.cs.depaul.edu 80 get /resources/ug_scholarships.asp section= |
| 2002-04-01 00:00:34 chf-1111-202.rasserver.net - w3svc3 bach bach.cs.depaul.edu 80 get /courses/syllabus.asp course=468- |
| 2002-04-01 00:00:35 12-250-96-248.client.attbi.com - w3svc3 bach bach.cs.depaul.edu 80 get /courses/syllabisearch.asp - |
| 2002-04-01 00:00:36 w010.z064221069.chi-il.dsl.cnc.net – w3svc3 bach bach.cs.depaul.edu 80 get /programs/default.asp – 2 |
| 2002-04-01 00:00:40 ac9781e5.ipt.aol.com - w3svc3 bach bach.cs.depaul.edu 80 get /advising/nsf_scholarships.asp - 200 62 |
| 2002-04-01 00:00:44 w010.z064221069.chi-il.dsl.cnc.net - w3svc3 bach bach.cs.depaul.edu 80 get /programs/2002/gradse2002 |
| 2002-04-01 00:01:00 66-79-37-44.coastalnow.net - w3svc3 bach bach.cs.depaul.edu 80 get /resources/gae_guide.asp - 0 404. |
| 2002-04-01 00:01:00 66-79-37-44.coastalnow.net - w3svc3 bach bach.cs.depaul.edu 80 get /shared/404.asp 404;http://www.cs |
| 2002-04-01 00:01:07 w010.z064221069.chi-il.dsl.cnc.net - w3svc3 bach bach.cs.depaul.edu 80 get /programs/courses.asp dep |
| 2002-04-01 00:01:09 chf-il11-202.rasserver.net - w3svc3 bach bach.cs.depaul.edu 80 get /courses/syllabilist.asp - 200 71 |
| 2002-04-01 00:01:14 w010.z064221069.chi-il.dsl.cnc.net - w3svc3 bach bach.cs.depaul.edu 80 get /people/tacultyinto.asp i |
| 2002-04-01 00:01:15 ac90edea.ipt.aol.com - w3svc3 bach bach.cs.depaul.edu 443 post /cti/advising/display.asp - 200 1625 |
| 2002-04-01 00:01:20 chf-ill1-202.rasserver.net - w3svc3 bach bach.cs.depaul.edu 80 get /courses/syllabus.asp course=468- |
| 2002-04-01 00:01:31 1custó2.tnt40.chi5.da.uu.net – w3svc3 bach bach.cs.depaul.edu 80 get /courses/syllabus.asp course=31 |
| 2002-04-01 00:01:36 chf-il11-202.rasserver.net – w3svc3 bach bach.cs.depaul.edu 80 get /courses/syllabilist.asp – 200 71 |
| 2002-04-01 00:01:39 ac90edea.ipt.aoi.com – w3svc3 bach bach.cs.depaul.edu 443 post /cti/advising/display.asp – 302 2875 |
| 2002-04-01 00:01:43 ac90edea.ipt.aoi.com – w3svc3 bach bach.cs.depaul.edu 443 get /cti/advising/display.asp – 200 47 htt |
| 2002-04-01 00:01:47 12-250-96-248.client.attbi.com – w3svc3 bach bach.cs.depaul.edu 80 post /courses/syllabilist.asp - 2 |
| 2002-04-01 00:01:53 12-249-142-45.client.attbi.com – w3svc3 bach bach.cs.depaul.edu 443 get /courses/syllabisearch.asp – |
| 2002-04-01 00:01:58 cmt-1112-02.rasserver.net - w3svc3 bach bach.cs.depaul.edu 80 get /courses/syllabus.asp course=554- |
| 2002-04-01 00:02:01 12-250-96-248.client.attbi.com – w3svc3 bach bach.cs.depaul.edu 80 get /courses/syllabus.asp course= |
| 2002-04-01 00:02:08 ac90edea.npt.aoi.com - wssvcs bach bach.cs.depaul.edu 443 get /cti/advising/includes/faculty/account |
| 2007-04-01 00:07:71 cache-mtc-an01.ncnxv.anl.com - wssves hach bach.cs.denaul.edu 80 net /nennle/detault.asn - 200 47 ht |
| Figure 3 Unprocessed log file of www.cs.depaul.edu |

Step 2: The next step is to convert the log file to database.

| ۵ | |
|--|--------|
| | |
| Please select the raw weblog to processed Diprojectiunprocessedfile.bd | Browse |
| Fields delimited by |] |
| Lines delimited by In |] |
| Convert to database | |

Figure 4 Selection of log file, specifying line and fields delimiters for the selected log file

The steps involved in the conversion of dataset to database are as follows:

- Log on to MySQL command line client.
- Create a table with all required attributes.
- Import the log files into database.

The MySQL commands are shown in figure below:



Figure 5 MySQL command prompt showing the commands used to create and load log database.

The database containing the entries of weblog is shown below in Fig 6

Step 3: The database has 5061 records. The count of entries for different IP addresses is obtained. There are entries having very low support count. Such entries need not be considered. The database is segmented into clusters having support count more than 20.

Step 4: The entries for IP addresses having support count greater than or equal to 30 are used for further analysis. There are 8 unique IP addresses having support count greater than or equal to 30.

These IP addresses are shown in fig 10.

| H | Thins D | | | Cisteria Soname | Stamps | ana Bu | Sport | Csmathod | Csustem | Calquey | Statutes | Throutaken | Consider | Csheat | Aport | Fat |
|-------------------|--|-------------------------------------|----------------|----------------------|----------------------|-------------------------------------|----------------|-----------------|-------------|----------|-------------------|----------------|-------------------------------|----------------------------|-------------------------|---------------|
| ilm | 1, 1930 ac\$711 | 6 1172.15 | | winci | bech | bach cs é | 10 | lat. | httend. | | 200 | 15 | http://.1 | hanny ca. | mrth/4 | https |
| 114 | L 1970 alphal | a 13 F | 7 | alma! | hech | bach es é | 1 | let. | Vefault are | | 302 | 1 | htpi1.1 | www.cs. | nmb4 | 1.00 |
| lia | 1, 1010 w010 : | 08 64 21 | 63 | lonks . | bach . | bach cr d | 1 | Ref. | Metall and | | 10 | 1 | http:// | WWW.CL. | Inging 4 | 1 |
| 43a | 5468 0FPL 1 | a 139 K | 7 . | ia3mti | bech | bach ct d | 1 | er. | /seasured | | 202 | 63 | http:// | WWW CS. | meth/4 | |
| 534 | 1, 1970 w018; | 06. 64 321 | 68 - | Erece | Neth | beth ct 6 | 1 | M | lows/fef | | 308 | | btb/1.1 | WWW.(S) | meth/4 | - |
| őJut. | 1, 1930 ac\$78 | 6 1711 | | (a3evc3 | bech | bach cs d | 1 | lat. | ोसजजरत | sectore. | 208 | | http/1.1 | WWW.cs. | neth4 | htp:// |
| 73m | 1, 1970 w010 : | 06.64.20 | 68 | [wilwo] | bach | bach os d | 1 | lgd. | propurs. | | 308 | 11 | htpi11 | www.cs. | resh4 | htpl |
| . Elas | 1, 1970 ac\$781 | 6 171 1 | | Lower L | bech | bach cr.d | 1 | liget. | htrong. | | 200 | \$25 | 1001 | www.cs. | perils/4 | htps |
| (Lat | 1, 1910 with: | 08 (64 22) | 68 | kiwiwi | bech | - bach cs d | 1 | ligd. | tragars. | | 300 | | http://.1 | WWW CE. | nrsk4 | htps |
| 10Jar | 1, 1733 (4-77- | 1- 101 78 | 744 | kiwiki | heth. | bath cr.d | 1 | 25 | manaces | 10494 1 | 303 | | bto/1.1 | WWW.GL | nr38/4 | https |
| LURE | 1, 1910 (6-19- | 1- 66.79 | 1.44 | Esveek | 70eth | bach ct d | 1 | 20. | Mared41 | 4043493 | 300 | | bb/1.1 | WWW.GL | nc184 | htp/ |
| 125m | 1, 1970 WOLE: | 06.64.22 | 68 | Live(se | bech. | bach or d | 11 | let. | brogues. | decode- | 308 | 140 | http://l.1 | WWW.CS. | mmb/4 | htp |
| 133m | 1, 1930 w010 : | 06.64.221 | 51 | [3765w] | bach | bach es d | 1 | pt. | people in | 115-211 | 308 | 673 | btb/1.1 | WWW.CS. | netb4 | http:// |
| 14.1at | 1, 1970 action | s 1723 | 12 | ladard. | bech | bach cr d | 44 | feet | chabes. | | 110 | 1625 | httpi11 | WARK CS. | mmla/4 | https |
| 15Jan | 1, 1910 active | 8. 121.14 | 11 | [wiw] | heth | bach os d | 44 | best | htplatter. | | 313 | 305 | htp/1.1 | WWW CE. | inmis/4 | http:/ |
| 161a | 1, 1970 a:40e | a 171 14 | 42.1 | Enfer | hetti | bach ce d | - 44 | at | Athladite | | 330 | 43 | http/11 | WWW.ce. | meth/4 | http:// |
| 17.5et | 1, 1020 4:404 | 6 172.54 | 41 - | w3mt3 | hath | bach ca d | 44 | at | Atlabte | | 300 | 63 | hts/1.1 | WWW/A | mmB/4 | http:// |
| 18.5as | 1 1970 cache- | nt (411 | 17 | Evice | bach | bach es d | 1 | 24 | bacelable | 4 | 300 | -47 | bb/1.0 | WWW CS. | perils4 | http:// |
| 103m | 1 1270 a-541 | 0 1711 | 11 | index.1 | hath | hach or d | 8 | pt. | Made of sea | | 303 | | http://11 | NUMBER OF | merilali | 1. |
| . Wilso | 1, 1010 ac[4] | 0 1711 | 11 | wheel | hach . | bach or 6 | 1 | 24 | heastlef | | 338 | 63 | http://1 | www.cs | meth/4 | - |
| 21.64 | L 1010 cade | nt 64.12 | 16 | iwing! | hadh | bach cs d | ÷. | ad . | (people los | | 10 | 123 | b0o(1.0 | WWW (8) | mmla/4 | Inter V |
| 22334 | 1, 1910 14-143 | 8. 04.14 | 81 - | EW/Ref | bach. | bach es é | 1 | ar. | Mefeld and | | 311 | 1 | http:// | latura cs. | metala/4 | 1 |
| 2334 | 1, 1970 24-145 | 8 24 143 | 51 - | w3wd | bath : | bach cs.d. | 8 | lat. | hews/lef | | 310 | | http:// | WWW.cs. | menia4 | - |
| 34.Det | 1, 9930 ac0411 | 0 172.13 | 11 | is a second | hach | Bach ce d | 20 | at . | deleved. | | 110 | 11 | http:// | NUMBER OF | mmilt/4 | http:// |
| 253at | 1 1970 34-348 | 8 14 143 | 81 - | wind. | bach | bach es é | 10 | ad. | (cornes) | | 300 | 18 | http://.1 | WHEN CS. | inglight. | htp:(|
| Miat | 1. 1970 haratas | pt 13 13 | 13 | wind | bach . | bach or d | 1 | at | ATTRACTO. | detraw. | 100 | | http:// | WWW.CS. | bra/lire | 1 |
| 213at | 1, 1970 14-145 | 8 3414 | 21 | is lovely | hech | bach cs é . | 1 | pe. | /courses/s | | 300 | 40 | bitol1.1 | www.cs. | netipi4 | htes |
| Nist | L 1970 (safet | er. 1163 23 | 41 | 10/2023 | beth | bach ct d | 1 | lat. | Adminis | | 208 | 16 | http/10 | 9999.01 | mm12/4 | https |
| 20134 | 1, 1910 (subs) | e 1613 | 41 | k3w2 | bach. | bach on 6 | 8 | lat. | bdrassa. | | 318 | 1 | Hely10 | WWW (6) | metB/4 | http:// |
| 303m | 1, 1970 acleiv | 4. 171.14 | | k3m2 | beth | bath cs d | - 44 | ad. | htistales. | | 303 | 1 | http:// | WWW.CL | menila/4 | http:// |
| 363m | 1, 1930 acile7e | H. 171 H | 11 | [176CW | bech | bach os é | 40 | at | luthent: | inter- | 208 | 3 | htp/1.1 | WWW.CS. | meth/4 | hter |
| 315at | 1, 1970 acleie | 4 171 3 | 11 | links. | heth : | bach or d | 44 | feet | latheric. | | 303 | 546 | htp(1.1 | www.cs | perils/4 | http:// |
| Nin Nin Nin | L. 1970 actiefe L. 1970 actiefe L. 1970 actiefe L. 1970 actiefe | H . 171 H H . 171 H H . 171 H | 11 11 11 | wiwi wiwi wiwi | bech bech bech | bach cs é bach cs é bach cs é | 40 40 40 | gt gt put | kathenis: | ietara . | 303 303 303 | 1 11 546 | htp:1.1 htp:1.1 htp:1.1 | VVV.CL VVV.CL VVV.CL | ncibi ncibi ncibi | Tapitarian In |

Figure 6 The database of weblog entries

The following fig 7 shows the entries of IP addresses having support count greater than or equal to 20.

| 🛓 Suppor | 120 | 1 P | 180 | | | | | | | | | | | | | 1 | | - 8 |
|----------|------------|----------|------------|--------------|----------|--------|---------|------------|-------|----------|--------------|------------|----------|-----------|-----------|-----------|-------------|--------------|
| id | tdate | time | cip | ip | csusema. | ssname | scompna | sip | sport | csmethod | csustem | csuquery | scstatus | timetaken | csversion | cshost | agent | referer |
| 33 | 2002-04-01 | 10:04:45 | adsi-65-4. | 65.42.87.2 | | w3sit3 | bach | bach.cs.d. | 80 | get | ldefault asp | | 302 | 16 | http/1.1 | www.cs.d. | mcella4.0. | |
| 34 | 2002-04-01 | 10:04:45 | adsi-65-4. | 65.42.87.2 | | w3sit3 | bach | bach.cs.d | 80 | get | hews/def | | 200 | 63 | http:/1.1 | www.cs.d. | mozilla4.0. | |
| 36 | 2002-04-01 | 10:05:42 | adsl-65-4. | 65.42.87.2 | | w3sit3 | bach | bach.cs.d. | 80 | get | ladvisingld. | | 200 | 31 | http:/1.1 | www.cs.d. | mozilla4.0. | http://www. |
| 37 | 2002-04-01 | 00.05:56 | adsl-65-4. | 65.42.87.2 | | w3sit3 | tach | bach.cs.d. | 80 | get | ltourses/d. | | 200 | 94 | http:/1.1 | www.cs.d | mczila4.0. | http://www. |
| 39 | 2002-04-01 | 10:06:37 | adsi+65-4. | 65.42.87.2 | - | w3sit3 | bach | bach.cs.d. | 80 | get | itoursesis . | | 200 | 500 | http:/1.1 | www.cs.d. | mczila40. | .http://www. |
| 74 | 2002-04-01 | 00:12:38 | adsH65-4. | 65.42.87.2 | - | w3sit3 | bach | bach.cs.d | 80 | get | itoursesiti. | | 200 | 93 | http:/1.1 | www.cs.d. | mczila4.0. | .http://www. |
| 76 | 2002-04-01 | 00:12:50 | adsi-65-4. | 65.42.87.2 | | w3sxt3 | bach | bach.cs.d | 80 | get | lprograms. | depcode= | 200 | 265 | http:/1.1 | www.cs.d. | mozila4.0. | http://www. |
| 78 | 2002-04-01 | 00:13:39 | adsi-65-4. | 65.42.87.2 | | w3sxt3 | bach | bach.cs.d | 80 | get | ipecpleita | id=250 | 200 | 360 | http:/1.1 | www.cs.d. | mozilla4.0. | http://www. |
| 103 | 2002-04-01 | 00:20:49 | 146.180.9. | . 146.180.9 | | w3sit3 | bach | bach.cs.d | 80 | get | ldefault asp | | 302 | 16 | http:/1.0 | www.cs.d. | mceilla4.0. | |
| 104 | 2002-04-01 | 10:20:49 | 146,180,9 | . 146.180.9 | | w3sit3 | bach | bach.cs.d. | 80 | get | hews/def | | 200 | 297 | http:/1.0 | www.cs.d | mczila4.0. | |
| 105 | 2002-04-01 | 10:20:52 | 146,180,9 | . 146.180.9 | - | w3sit3 | tach | bach.cs.d. | 80 | get | itoursesiti. | | 200 | 110 | http:/1.0 | www.cs.d | mczila40. | .http://www. |
| 106 | 2002-04-01 | 10:20:58 | 165.252.2 | 165.252.2 | - | w3sit3 | bach | bach.cs.d. | 80 | get | idefault asp | | 302 | 16 | http:/1.1 | www.cs.d. | mczila40. | |
| 107 | 2002-04-01 | 10:20:58 | 165.252.2 | 165.252.2 | - | w3sit3 | bach | bach.cs.d | 80 | get | hews/def | | 200 | 62 | http:/1.1 | www.cs.d. | mczila4.0. | |
| 108 | 2002-04-01 | 00:21:08 | 146.180.9. | . 146.180.9 | | w3sit3 | bach | bach.cs.d | 80 | get | lprograms. | deptrme= | 200 | 281 | http:/1.0 | www.cs.d. | mozilla4.0. | http://www. |
| 109 | 2002-04-01 | 00:21:11 | 165.252.2 | . 165.252.2. | | w3sxt3 | bach | bach.cs.d | 80 | get | lpecpleide. | | 200 | 47 | http:/1.1 | www.cs.d. | mozilla4.0. | .http://www. |
| 110 | 2002-04-01 | 00:21:16 | 165.252.2 | . 165.252.2 | | w3sit3 | bach | bach.cs.d | 80 | get | lpeopleise. | | 200 | 531 | http:/1.1 | www.cs.d. | mceilla4.0. | .http://www. |
| 111 | 2002-04-01 | 10:21:16 | 146,180,9 | . 146.180.9 | | w3sit3 | bach | bach.cs.d. | 80 | get | itoursesis . | | 200 | 468 | http:/1.0 | www.cs.d | mczila40. | .http://www. |
| 112 | 2002-04-01 | 10:21:19 | 146,180,9 | . 146.180.9 | - | w3sit3 | tach | bach.cs.d. | 80 | get | lprograms | | 200 | 31 | http:/1.0 | www.cs.d | mczila40. | .http://www. |
| 113 | 2002-04-01 | 10:21:26 | 165.252.2 | 165.252.2 | - | w3sit3 | tach | bach.cs.d | 80 | get | lpecpleifa | id=262 | 200 | 1078 | http:/1.1 | www.cs.d. | mczila40. | .http://www. |
| 114 | 2002-04-01 | 00:21:30 | 146.180.9. | . 146.180.9 | | w3sit3 | bach | bach.cs.d. | 80 | get | lprograms. | | 200 | 47 | http:/1.0 | www.cs.d. | mozila4.0. | http://www. |
| 115 | 2002-04-01 | 10:22:00 | 146.180.9. | . 146.180.9 | | w3sxt3 | bach | bach.cs.d | 80 | get | lprograms. | | 200 | 31 | http/1.0 | www.cs.d. | mozilla4.0. | http://www. |
| 116 | 2002-04-01 | 00:22:04 | 146.180.9. | 146.180.9. | | w3sxt3 | bach | bach.cs.d | 80 | get | lprograms. | | 200 | 31 | http:/1.0 | www.cs.d. | mozila4.0. | .http://www. |
| 122 | 2002-04-01 | 00:23:13 | 165.252.2 | 165.252.2. | | w3sxt3 | bach | bach.cs.d. | 80 | get | llogin asp | section=m. | 302 | 0 | http:/1.1 | www.cs.d | mozila4.0. | http://www. |
| 123 | 2002-04-01 | 00.23:15 | 165.252.2 | 165,252.2 | - | W35NE3 | bach | bach.cs.d. | 443 | get | lauthentic | section=m. | 200 | 31 | http:/1.1 | www.cs.d | mozila4.0 | http://www. |
| 124 | 2002-04-01 | 10:23:15 | 165.252.2 | . 165.252.2 | - | w3sit3 | bach | bach.cs.d. | 80 | get | llogin asp | section=m. | 302 | 0 | http://.1 | www.cs.d. | mccila40. | http://www. |
| 125 | 2002-04-01 | 00:23:17 | 165.252.2 | 165.252.2 | | w3sit3 | bach | bach.cs.d. | 443 | get | lauthentic | section=m. | 200 | 16 | http:/1.1 | www.cs.d. | mczila4.0. | .http://www. |
| 128 | 2002-04-01 | 10:23:54 | adsi-65-4. | 65.42.87.2 | | w3sit3 | bach | bach.cs.d. | 80 | get | lpeopleiga. | | 200 | 219 | http:/1.1 | www.cs.d. | mozila4.0. | .http://www. |
| | | | | | OK | | | | | | | | | | | | | |

Figure 7 Weblog entries with IP addresses having support count greater than or equal to 20

The following fig 8 shows the entries of IP addresses having support count greater than or equal to 25.

| id | tdate | time | cip | ip . | csusema | ssname | scompna. | sip | sport | csmethod | csustem | csuquery | scstatus | timetaken | csiersion | cshost | agent | refer |
|----|------------|----------|-----------|-------------|---------|--------|----------|--------------|-------|----------|--------------|------------|----------|-----------|-----------|-----------|---------|----------|
| 3 | 2002-04-01 | 00:04:45 | adsi-65-4 | 65.42.87.2 | | w3sic3 | bach | bach rs.d. | 80 | get | ldefault asp | | 302 | 16 | htpi1.1 | www.cs.d | mozila4 | - |
| Į. | 2002-04-01 | 00:04:45 | atsi-65-4 | 65.42.87.2 | | w3sic3 | bach | bach rs.d | 80 | get | newsidef | | 200 | 63 | htpil.1 | www.cs.d. | mozila4 | - |
| 6 | 2002-04-01 | 00:05:42 | adsH65-4 | 65.42.87.2 | | w3sxc3 | bach | bach rs.d | 80 | get | ladvisingl | | 200 | 31 | htpi1.1 | www.cs.d. | mozila4 | htpoles |
| 1 | 2002-04-01 | 00:05:56 | adsi-65-4 | 65.42.87.2 | | w3sxc3 | bach | bach rs.d | 80 | get | ltourses/d | | 200 | 94 | htpi1.1 | www.cs.d. | mozila4 | htpohe |
| 3 | 2002-04-01 | 00:06:37 | adsi-65-4 | 65.42.87.2 | | w3sxc3 | bach | bach rs.d. | 81 | get | ltourses/s. | | 200 | 500 | htpi1.1 | www.cs.d. | mozila4 | htpolw |
| 4 | 2002-04-01 | 00:12:38 | adsi-65-4 | 65.42.87.2 | | w3sxc3 | bach | bach rs.d., | 81 | get | ltoursesid. | | 200 | 93 | htpi1.1 | www.cs.d. | mozila4 | http://w |
| 6 | 2002-04-01 | 00:12:50 | adsi-65-4 | 65.42.87.2 | | w3sxc3 | bach | bach rs.d., | 81 | get | lprograms | depcode= | 200 | 265 | htpi1.1 | www.cs.d. | mozila4 | htp://w |
| 8 | 2002-04-01 | 00:13:39 | adsi-65-4 | 65.42.87.2. | | w3sic3 | bach | bach rs.d., | 81 | get | lpeopleifa | id=250 | 200 | 360 | htpi1.1 | www.cs.d. | mozila4 | htpohr |
| 13 | 2002-04-01 | 00:20:49 | 146.180.9 | 146.180.9 | | w3sic3 | bach | bach r.s.d., | 80 | get | ldefault.asp | | 302 | 16 | htpi1.0 | www.cs.d. | mozila4 | |
| 14 | 2002-04-01 | 00:20:49 | 146.180.9 | 146.180.9 | | w3sic3 | bach | bach r.s.d., | 80 | get | /newsidef | | 200 | 297 | htpi1.0 | www.cs.d. | mozila4 | |
| 16 | 2002-04-01 | 00:20:52 | 146.180.9 | 146.180.9 | | w3sic3 | bach | bach r.s.d., | 80 | get | ltoursesid. | | 200 | 110 | htpi1.0 | www.cs.d. | mozila4 | http://w |
| 16 | 2002-04-01 | 00:20:58 | 165,252.2 | 165.252.2 | | w3sic3 | bach | bach r.s.d., | 80 | get | ldefault asp | | 302 | 16 | htpil.1 | www.cs.d. | mozila4 | |
| 07 | 2002-04-01 | 00:20:58 | 165,252,2 | 165.252.2 | | w3sic3 | bach | bach r.s.d., | 80 | get | inewsidef | | 200 | 62 | htpil.1 | www.cs.d. | mozila4 | |
| 18 | 2002-04-01 | 00:21:08 | 146.180.9 | 146.180.9 | | w3sic3 | bach | bach r.s.d | 80 | get | (programs | deptmne= | 200 | 281 | htpi1.0 | www.cs.d. | mozila4 | http://w |
| 19 | 2002-04-01 | 00:21:11 | 165,252,2 | 165.252.2 | | w3sic3 | bach | bach r.s.d | 80 | get | lpeopleide. | | 200 | 47 | htpil.1 | www.cs.d. | mozila4 | http://w |
| 10 | 2002-04-01 | 00:21:16 | 165,252,2 | 165.252.2 | | w3sic3 | bach | bach r.s.d | 80 | get | lpeopleise. | | 200 | 531 | htpil.1 | www.cs.d. | mozila4 | http://w |
| 11 | 2002-04-01 | 00:21:16 | 146,180,9 | 146.180.9 | | w3sic3 | bach | bach r.s.d | 80 | get | ltoursesis. | | 200 | 468 | htpi1.0 | www.cs.d. | mozila4 | http://w |
| 12 | 2002-04-01 | 00:21:19 | 146,180,9 | 146.180.9 | | w3sic3 | bach | bach r.s.d | 80 | get | (programs | | 200 | 31 | htpi1.0 | www.cs.d. | mozila4 | http://w |
| 13 | 2002-04-01 | 00:21:26 | 165,252,2 | 165.252.2 | | w3sic3 | bach | bach r.s.d | 80 | get | lpeopleifa | id=262 | 200 | 1078 | htpi1.1 | www.cs.d. | mozila¥ | http://w |
| 14 | 2002-04-01 | 00:21:30 | 146,180,9 | 146.180.9 | | w3sic3 | bach | bach rs.d., | 80 | get | (programs | | 200 | 47 | htpi1.0 | www.cs.d. | mozila¥ | http://w |
| 15 | 2002-04-01 | 00:22:00 | 146,180,9 | 146.180.9 | | w3sic3 | bach | bach rs.d | 80 | get | (programs | | 200 | 31 | htpi1.0 | www.cs.d. | mozila¥ | htpha |
| 16 | 2002-04-01 | 00:22:04 | 146,180,9 | 146.180.9 | | w3sic3 | bach | bach rs.d., | 80 | get | (programs | | 200 | 31 | htpi1.0 | www.cs.d. | mozila¥ | htpha |
| 12 | 2002-04-01 | 00:23:13 | 165,252,2 | 165.252.2. | | w3sic3 | bach | bach rs.d., | 80 | get | llogin asp | section=m. | 302 | 0 | htpi1.1 | www.cs.d. | mozila¥ | htphy |
| 23 | 2002-04-01 | 00:23:15 | 165,252,2 | 165.252.2. | | w3sic3 | bach | bach rs.d | 443 | get | lauthentic | section=m. | 200 | 31 | htpi1.1 | www.cs.d | mozila4 | htpshi |
| 24 | 2002-04-01 | 00:23:15 | 165,252,2 | 165.252.2 | | w3sic3 | bach | tach.cs.d | 80 | get | llogin.asp | section=m. | 302 | 0 | htpil.1 | www.cs.d. | mozila4 | htp:/w |

Figure 8 Weblog entries with IP addresses having support count greater than or equal to 25

The following fig 9 shows the entries of IP addresses having support count greater than to equal to 30

| 106 | 2002-04 00:20:58 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 80 | get | /default | - | 302 | 16 | http/1.1 | WWW.CS | mozilal | - 1 | ŕ |
|-----|------------------|---------|---------|--------|------|---------|---------|------|------------|-----------|-----|------|----------|--------|----------|-----------|---|
| 107 | 2002-04 00:20:58 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 80 | get | /news/d | - | 200 | 62 | http/1.1 | www.cs | mozillal | | |
| 108 | 2002-04 00:21:08 | 146.180 | 146.180 | w3svc3 | bach | bach.cs | 80 | get | /progra | deptmn | 200 | 281 | http/1.0 | www.cs | mozillal | htp://ww | |
| 109 | 2002-04 00:21:11 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 80 | get | /people/ | - | 200 | 47 | http/1.1 | www.cs | mozillal | htp://ww | |
| 110 | 2002-04 00:21:16 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 80 | get | /people/ | - | 200 | 531 | http/1.1 | www.cs | mozillal | http://ww | |
| 111 | 2002-04 00:21:16 | 146.180 | 146.180 | w3svc3 | bach | bach.cs | 80 | get | /courses | - | 200 | 468 | http/1.0 | WWW.CS | mozillal | http://ww | |
| 112 | 2002-04 00:21:19 | 146.180 | 146.180 | w3svc3 | bach | bach.cs | 80 | get | /progra | - | 200 | 31 | http/1.0 | www.cs | mozillal | htp://ww | |
| 113 | 2002-04 00:21:26 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 80 | get | /people/f | id=262 | 200 | 1078 | http/1.1 | www.cs | mozillal | htp://ww | |
| 114 | 2002-04 00:21:30 | 146.180 | 146.180 | w3svc3 | bach | bach.cs | 80 | get | /progra | | 200 | 47 | http/1.0 | www.cs | mozillal | htp://ww | |
| 115 | 2002-04 00:22:00 | 146.180 | 146.180 | w3svc3 | bach | bach.cs | 80 | get | /progra | - | 200 | 31 | http/1.0 | www.cs | mozillal | htp://ww | |
| 116 | 2002-04 00:22:04 | 146.180 | 146.180 | w3svc3 | bach | bach.cs | 80 | get | /progra | - | 200 | 31 | http/1.0 | WWW.CS | mozillal | htp://ww | |
| 122 | 2002-04 00:23:13 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 80 | get | /login.asp | section= | 302 | 0 | http/1.1 | www.cs | mozillal | htp://ww | |
| 123 | 2002-04 00:23:15 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /authenti | section= | 200 | 31 | http/1.1 | www.cs | mozillal | htp://ww | |
| 124 | 2002-04 00:23:15 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 80 | get | /login.asp | section= | 302 | 0 | http/1.1 | www.cs | mozillal | htp://ww | |
| 125 | 2002-04 00:23:17 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /authenti | section= | 200 | 16 | http/1.1 | www.cs | mozillal | htp://ww | |
| 129 | 2002-04 00:23:56 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | post | /authenti | - | 302 | 1672 | http/1.1 | WWW.CS | mozillal | htp://ww | |
| 132 | 2002-04 00:24:01 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /cti/stud | section= | 200 | 4407 | http/1.1 | www.cs | mozillal | htp://ww | |
| 133 | 2002-04 00:24:15 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /cti/stud | - | 200 | 219 | http/1.1 | www.cs | mozillal | htp://ww | |
| 137 | 2002-04 00:24:35 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /progra | | 200 | 391 | http/1.1 | www.cs | mozillal | htp://ww | |
| 142 | 2002-04 00:25:09 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /advisin | section= | 200 | 32 | http/1.1 | www.cs | mozillal | htp://ww | |
| 145 | 2002-04 00:25:22 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /login.asp | color=pr | 302 | 0 | http/1.1 | WWW.CS | mozillal | htp://ww | |
| 146 | 2002-04 00:25:24 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /authenti | color=pr | 302 | 15 | http/1.1 | WWW.CS | mozillal | htp://ww | |
| 147 | 2002-04 00:25:26 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /cti/darsi | section= | 200 | 1734 | http/1.1 | www.cs | mozillal | htp://ww | |
| 148 | 2002-04 00:25:32 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /cti/darsi | year=20 | 302 | 312 | http/1.1 | www.cs | mozillal | htp://ww | |
| 149 | 2002-04 00:25:32 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /cti/darsi | | 200 | 0 | http/1.1 | www.cs | mozillal | htp://ww | |
| 150 | 2002-04 00:25:40 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /cti/darsi | count=0 | 302 | 5125 | http/1.1 | www.cs | mozillal | | |
| 152 | 2002-04 00:25:41 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /cti/darsi | jobid=99. | 200 | 547 | http/1.1 | www.cs | mozillal | | |
| 153 | 2002-04 00:27:02 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /shared/l | - | 302 | 0 | http/1.1 | www.cs | mozillal | htp://ww | |
| 154 | 2002-04 00:27:03 | 165.252 | 165.252 | w3svc3 | bach | bach.cs | 443 | get | /default | - | 302 | 0 | http/1.1 | WWW.CS | mozillal | htp://ww | 4 |
| 155 | 2002-04 00:27:04 | 165 252 | 165.252 | w?svr? | harh | harh rs | 443 | net | /news/d | | 200 | 67 | httn/1 1 | 21,000 | mozilal | htn:lww | • |
| | | | | | | | | | | | | | | | | | |
| | | | | | | ſ | | - | | | | | | | | | |
| | | | | | | | Analyze | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

Figure 9 Weblog entries with IP addresses having support count greater than or equal to 30

| <u>*</u> | | | |
|------------------------|-----------------|---|---------------|
| | | | |
| Select an IP address : | 146.180.92.195 | • | |
| | 146.180.92.195 | | |
| | 165.252.27.130 | | |
| | 24.148.45.216 | | |
| | 66.32.38.228 | | |
| | 24.148.21.206 | | View Entries |
| | 199.174.179.217 | | |
| | 66./2.114.9/ | | |
| | 141.202.246.12 | | |
| | | | Sessionize |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | View Sessions |
| | | | |
| | | | |
| | | | |
| | | | |

Figure 10 IP addresses having support count greater than or equal to30.

The entries of the IP address selected by the user can viewed by clicking on the 'view entries' button.

| id | time | P | csustem | referer | timetaken | |
|----|----------|----------------|---|--|-----------|--|
| | 00:20:58 | 165.252.27.130 | ldefault.asp | - | 16 | |
| | 00:20:58 | 165.252.27.130 | inews/default.asp | - | 62 | |
| | 00:21:11 | 165.252.27.130 | lpeopleidefault.asp | http://www.cs.depaul.edu/news/defau | 47 | |
| | 00:21:16 | 165.252.27.130 | lpeopleisearch asp | http://www.cs.depaul.edu/people/ | 531 | |
| | 00:21:26 | 165.252.27.130 | lpeopleifacultyinfo.asp | http://www.cs.depaul.edu/people/sea | 1078 | |
| | 00:23:13 | 165.252.27.130 | login.asp | http://www.cs.depaul.edu/people/facu. | 0 | |
| | 00:23:15 | 165.252.27.130 | lauthenticatellogin.asp | http://www.cs.depaul.edu/people/facu | 31 | |
| | 00:23:15 | 165.252.27.130 | llogin.asp | http://www.cs.depaul.edu/people/facu | 0 | |
| | 00:23:17 | 165.252.27.130 | lauthenticatellogin.asp | http://www.cs.depaul.edu/people/facu | 16 | |
| 0 | 00:23:56 | 165.252.27.130 | lauthenticate/auth.asp | http://www.cs.depaul.edulauthenticat | 1672 | |
| 1 | 00:24:01 | 165.252.27.130 | icti/studentprofile/studentprofile.asp | http://www.cs.depaul.edulauthenticat | 4407 | |
| 2 | 00:24:15 | 165.252.27.130 | ictilstudentprofilelsuggestionlviewrec. | http://www.cs.depaul.edu/ctilstudentp_ | 219 | |
| 3 | 00:24:35 | 165.252.27.130 | lprograms/2002/gradcs2002.asp | http://www.cs.depaul.edu/ctilstudentp_ | 391 | |
| L | 00:25:09 | 165.252.27.130 | ladvisingldars.asp | http://www.cs.depaul.edu/programs/2_ | 32 | |
| 5 | 00:25:22 | 165.252.27.130 | llogin.asp | http://www.cs.depaul.eduladvisinglda_ | 0 | |
| 6 | 00:25:24 | 165.252.27.130 | lauthenticate/login.asp | http://www.cs.depaul.eduladvising/da. | 15 | |
| 1 | 00:25:26 | 165.252.27.130 | ittiitlarsinputicatalog.asp | http://www.cs.depaul.eduladvising/da | 1734 | |
| 8 | 00:25:32 | 165.252.27.130 | ittiitlarsinputicatalog.asp | http://www.cs.depaul.edu/ctildarsinpu | 312 | |
| 9 | 01/25:32 | 165.252.27.130 | (ctildarsinput/wait.asp | http://www.cs.depaul.edu/ctildarsinpu | 0 | |
| 0 | 00:25:40 | 165.252.27.130 | (ctildarsinputi)obs.asp | - | 5125 | |
| 1 | 00:25:41 | 165.252.27.130 | ictildarsinputidars.asp | | 547 | |
| 2 | 00:27:02 | 165.252.27.130 | isharedilogout asp | http://www.cs.depaul.edu/ctildarsinpu | 0 | |
| 3 | 00:27:03 | 165.252.27.130 | idefault.asp | http://www.cs.depaul.edu/ctildarsinpu | 0 | |
| L. | 00:27:04 | 165.252.27.130 | inews/default.asp | http://www.cs.depaul.edu/ctildarsinpu | 62 | |
| 5 | 00:27:35 | 165.252.27.130 | lprogramsidefault.asp | http://www.cs.depaul.edu/news/defau | 31 | |
| 6 | 00:28:12 | 165.252.27.130 | lcoursesidefault asp | http://www.cs.depaul.edu/programs/ | 484 | |
| 1 | 00:40:59 | 165.252.27.130 | ldefault.asp | | 0 | |
| 8 | 00:41:14 | 165.252.27.130 | lprogramsidefault.asp | htp://www.cs.depaul.edu/news/defau | 31 | |
| 9 | 00:42:10 | 165.252.27.130 | lprograms/2002/grades2002.asp | htp://www.cs.depaul.edulprograms/ | 422 | |
| 1 | 004517 | 165 252 27 130 | ladvisinoliavaloraduate aso | http://www.cs.depaul.edubmorams/7 | 391 | |

Figure 11 Entries of IP address selected from the drop down menu.

Sessions are identified. The session time is taken to be 5 minutes.



Figure 12 Screen which appears after sessions are created.

Depending on the pages requested the entries of each session are classified among 5 different predefined classes. The entries and the classification of entries of a session are shown in figure below.

| | (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) | | csubm | 1998 | Emetakan | |
|-------------|---|---------------------|---------------------------------------|--|----------|--|
| | 00.20.58 | 185.252.27.138 | /default asp | | 16 | |
| | 00.2055 | 16121237138 | (hevesidefault.ssp | | 62 | |
| | 002111 | 986.252.37.130 | ibeoplehtetaut asp | In ews literault and | 47 | |
| | 002116 | 165 252 27 538 | ibeopletsearch asp | (people/ | 531 | |
| | 30.21.26 | 195 252 37.138 | (beopleitacultyint) asp | Iperpletearch asp | 1078 | |
| | 002313 | 166 202 37:130 | /logn.ate | peoplefacultyrni asp%a=282 | 0 | |
| | 00/2315 | 155,252,37.138 | /authenticate/ogin asp | (propie/acultyret.asp?id=262 | 31 | |
| | 30 23 15 | 985.252.27.130 | Vogin.asp- | Ipeoplefacultyint app76±282 | 0 | |
| | 0022117 | 165 252 27 138 | visuthenticate/cgin.asp | (people/faculty:nfo asp?id=282 | 10 | |
| | 00.2156 | 185.252.27.538 | Faultienticate/auth-asa | Jauthenticate/upit.asp?sector=my. | 1672 | |
| | 00:24:01 | 165 252 27 136 | ichtudertprofileithodertprofile 212 | authenticatelogin asp?section=my. | 4407 | |
| | 00.2415 | 165.252.37.138 | intintudentprofileisupgentioniviewre. | Intristudenty offendre budenty of a sep- | 219 | |
| | 00.3438 | 186 252 27 138 | (programs/2003/gradcs3082.asp | htistadertprofile/suggestan/vewra | 391 | |
| | 第四部 | 155 252 37 136 | Vadvising/bars.asp | http://www.com/com/com/com/ | 33 | |
| | 00/25/22 | 186.252.27.538 | Voginasp | adveingides.eep?eechot=orogra. | 0 | |
| | 2023X | 195 252 37 130 | dauthenticatelitopin.asp | ladvangidars asp?sector+progra. | 11 | |
| | 002528 | 186 262 37:138 | VtShbaramputXcatalog.asp | ladveingidars asp?sector=progra. | 1734 | |
| | 00 25 32 | 185 252 37 138 | (risitizes inputicatalog asp | Indictors inputitatalog asp?tectionen | 312 | |
| | 302533 | 995.292.37.530 | josidansinputiwait.asp | Adicarsinguitatelegaag?sectionen | .0 | |
| | 002540 | 161 212 27 138 | (räldarsinputijoërs asp | | 5125 | |
| | 第四相 | 168 252 27 138 | vitilitars inputitiars, and | | 547 | |
| | | | | | | |
| The entries | of this session an | e found to belong t | o following classes: cla | iss A | 50 | |
| | | | Cla | ISS C | | |
| | | | | | | |

Figure 13 Entries belonging to session of 5 minutes and the classes to which the entries are classified.

After all sessions are viewed, the association rules can be viewed. These association rules show the relation between the IP address and the pages requested by the clients from that IP address. The association rules for IP address 165.252.27.130 are shown in the following figure.

| The association rules for the selected IP address are as follows |
|--|
| 165.252.27.130>news |
| 165.252.27.130>people |
| 165.252.27.130>authenticate |
| 165.252.27.130>studentprofile |
| 165.252.27.130>programs |
| 165.252.27.130>advising |
| 165.252.27.130>darsinput |
| 165.252.27.130>shared |
| 165.252.27.130>courses |
| |

Figure 14 Association rules for the IP address 165.252.27.130

V. CONCLUSION

Web Usage Mining is an aspect of data mining that has received a lot of attention in recent years.

In this paper, implementation of a system for pattern discovery using association rules is discussed as a method for Web Usage Mining. Different transactions that are closely related to each other are grouped together by the use of clustering approaches on the preprocessed dataset.

The analysis of such clusters will lead to discovery of strong association rules. We obtained all significant association rules between items in the large database of transactions. The relation between different page requests was found.

The support and the confidence values of extracted rules are considered for obtaining the interest of the web visitors. Consequently, the number of hit can be increased by analyzing the visitor attitude.

The approach discussed in this paper, helps the web designers to improve their website usability by determining related link connections in the website.

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