



SOFTWARE AGENTS PARADIGM IN AUTOMATED DATA MINING FOR BETTER VISUALIZATION USING INTELLIGENT AGENTS

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ABSTRACT

Data Mining techniques plays a vital role like extraction of required knowledge, finding useful information to make strategic decision in a novel way which in term understandable by domain experts. Users like expert user, novice user and connoisseur user in which expert user can complete process on its own knowledge while compared to novice user and connoisseur user because of their less domain knowledge. The inadequate lead to grow user like novice and connoisseur user more. With these properties they are not at all more significant users like expert users. By considering these aspects agents are implemented to perform the specified task on behalf of less domain user in which selection of appropriate mining techniques, appropriate algorithms, and proper decision making for producing better results. In these paper, multiple agents are considered to perform differ unique task with proper communication and collaboration with each agents in the name of automated process for better visualization and cluster detection for less domain users.

Keywords: *Data Mining Techniques, Multi –Agent Systems, Agents Role, Visualization*

1. INTRODUCTION

Usually, huge amount of data is being generated with respect to different application process either manually or electronic type in real world. Thus, collection of different data without any hesitation on its nature of the data, data types and its origin in the name of storage is known as data warehousing from which data are specifically extracted, fine tuned and made utilized based on the user needs [16][19].

There are different types of data analysis techniques are made available in data mining like decision making, prediction, classification and clustering used to find new patterns from the existing database whenever it is necessary [16][19]. Generally, the process of finding such pattern is not an easy task. An extracting required information from the well known data sets for making decisions and predictions in a comfort way is also known as data mining [16]. In the view of data mining, the retrieval of

required amount of data from the huge data sets is a difficult process and also not a easy one at all the time and also for all the users especially for less knowledge domain experts users like novice and connoisseur users. Even though, when any user from less domain knowledge user tried to perform task will also expects the end results that too should be clear, readable, meaningful and understandable to all types of user. But, to perform above mentioned task each user has to be well domain expert expertise so as to perform the task in minimal time by choosing appropriate parameters and appropriate data mining techniques according to database nature for better meaningful results.

Generally, every data miner should know complete domain knowledge on how to mine required data, which type of data mining techniques has to identified based on the problem, in addition to this they should also know which techniques and which methods should be used specifically during or before



starting the mining process [35]. But it is quite difficult in our day-to-day life unless they are not good domain expertise. In this research work, on behalf of less domain user, agents learn some domain knowledge from the previous user history data so as to make the flow process easier while compared to domain experts. Various agents are considered in this research work by considering less domain user in mind. These agents perform the process on behalf of less domain user in every critical situation [15][21][25][30][31][32][4]. The guidance and supports for each agent is done through agents cooperation, collaboration, and negotiation with other agents through frequent communications with one another within its formulated environment so as to perform the task on behalf of less domain user [2][21]. Basically, there is no unique definition for Agent. Agent is defined as an entity that can be define an agent as an entity that can be viewed as perceiving its environment through sensors and acting upon its environment through effectors [31][1]. In this research work, Multi-Agents like user profile agent, data mining agent, decision agent, visual agent and cluster detection agents are considered to perform the user tasks at different levels while during mining process based on the previous user's histories with the help of user profile agent. With these, majority of the critical works like selection of mining techniques, attributes, cluster detection, and visualization of end results are completed by different agents as above mentioned for less domain users [39][20]. Thus, [9][6][5] majority of the works will get minimize and also decision making policy will also done by agents is an added advantage in this proposed work. In this paper different agents are incorporated within this proposed model to perform different tasks on its own request and other agents request by means of collaborations and cooperation with each other agents in its environments [21][33][31][11].

A system which performs the defined task individually on its own knowledge based on previous history of data, without or less user interaction is known as autonomous system[23][26][37][45][47]by which entire process gets automated. In this research work, automated concepts is considered to automate each agents present within its environment to perform their task on its own in which collaboration and cooperation among agents so as to maximizes the processing speed and

minimizes the user interactions [4][6][35][32][24][27]. The most important strategy of implementing automated data mining systems in data mining is to avoid majority of risks happening during selection of suitable techniques, cluster identification, cluster detection and appropriate visualization tool for proper decision making is an most important issue in the real world application process especially in the case of less domain user[42][44]. As part of these, automation of all the agents is made automated in this research work based on the user needs automated system will soon complete the particular task based on the request and responds. With these, cluster formation, detecting the interesting patterns for finding out the appropriate knowledge from the given data set are identified is an interesting issue in this research work. Finally, the clusters of good quality are identified for visualization by using appropriate visualization methods and tools for proper decision making [36]. The issues faced by non experts during finding new patterns or knowledge with the help of multi-agents and automated system in association with data mining techniques for better cluster detection and visualization will overcome the existing drawback face by the non expert users from these approach.

2. AUTOMATED DATA MINING FOR BETTER RESULTS

Development of user friendly automated data mining system using intelligent agent is one of the mile stone in our research. The main aim of this paper is to developing a neutral system using well known data mining techniques like partition method and multi-agent systems[15][14].

Data mining is a process in which knowledge are discovered while during analyzes in large quantity of data sets gives unknown patterns, hidden data in the name of useful information[19][16][29]. Data mining is the techniques used in different fields like business, weather forecast, medicine, healthcare, transportation, insurance, government sectors, educations and etc,. Data mining gives lot of advantages while using different data mining techniques [19][7]. But it has its own drawback before starting and after completion of data mining. The user should be domain expert user so as to overcome the post drawback and pre drawback. The problem identifies in pre data



mining are improper usage of data mining techniques, improper selection of unwanted fields or records, improper techniques and methods, improper analysis, etc.,

There are different types of data mining techniques have been developed and used by many different data miner in their projects [19][16][7]. They are association, clustering, prediction and sequence pattern. From these, clustering and prediction techniques are considered to find new patterns [43]. The clustering techniques are used to formulate new clusters whereas prediction techniques are used to find the quality of cluster which is formed during clustering using automated data mining.

Clustering is also one of the data mining techniques [19][16][10] which are used to make meaningful clusters of objects that have similar characteristic using automated techniques [8]. Clustering is entirely differs from classification by means of objects into predefined classes, but in clustering a particular group of object of same category are grouped together is known as clustering [43]. Prediction is a data mining techniques which is used to discover the relationship between dependent and independent variables [43].

Different types of agents are considered in this research work to perform task, with stage by stage in a well do to manner. Agent consider in this approach specifically varies in their role while performing operation with one another [6][4]. Thus, these agents are called as Multi-Agents systems used to automate the automated data mining system in this work[18][34][14]. Multi-Agent technology is considered to increase the user performance by means of agent paradigm to increase the performance level, easy completion of task by different levels of user which these collaborate and negotiation takes place within its environment agents [15][14][3].

The developed automated system fetch the input parameters form the various user profile using user profile agent and chooses the appropriate data mining techniques with required parameters using data mining agents in which new clusters are also formulated by means of data mining techniques[38][37][27][35][41][40]. Finally, the data mining agents system also detects the quality of clusters (good or bad) with respect to user profile by means of knowledge agent.

Finally, clusters with good nature made visualization by visual agent [40].

Multi-Agents are considered in this research work to overcome the deficiency of manual data mining process, single agent overload with these, proposed method gives better performance for non expert users with the help of multi-agents using intelligent [24][35][12][17][42][44]. It mainly consists of user agent, data mining agents, knowledge agent, decision agent, ranking agent and visual agent are involved in this work to overcome the non-domain experts problem as mentioned below.

The major problems identified with non-domain experts are [35]:

- a. Difficult to find the suitable data mining techniques.
- b. Difficult in selection appropriate algorithms.
- c. Difficult to find the interested patterns (clusters).
- d. Difficult to analysis clustered patterns.
- e. Difficult in selecting an appropriate tool for visualization to take proper decision making.

The user agent is considered to navigate user profile in which whether particular user interrupts system frequently or occasionally is identified based on the previous history or activities of the particular user. Correspondingly, data mining agent collect the history of a particular user with respect to specific user by selecting different mining algorithms based on the user navigation for better results in a shorter time with the help of knowledge agent. Multi-Agent systems are considered to select the required parameter for the specific user to perform automated system in a better manner [35][13].

3. DATA BASE CONSIDERED

Data sets considered in this research work is student database, which contains 50,000 records and 20 attributes in each record with different data types. The data types considered in this work are numerical data and categorical data. Some of the attributes which is considered in our research work are REG_NO, NAME, YEAR, SEMESTER, ASSIG_PARAMETER, MAX_MARK, MIN_MARK, LIB_ACCNO,



ISSUE_DATE, RETURN_DATA, ACC_NO, SPECIALIZATION, STREET_NO, STREET_NO, PLACE, COUNTRY, MODULE_CODE, TUTOR_NAME, EMAIL_ID, TEL_PHONE, SESSION, PASS_PERCENTAGE, AVG_INT, AVG_EXT, AVG_TOT, ASSIGNMENT_REPORT, SELF_STUDY, LAB_EXAM1, LAB_EXAM2, END_CYCLE, PROJECT_REPORT, GROUP_REPORT, HOME_WORK, etc.,

According to data sets considered are student data sets, from which the actual student's performance is evaluated by analyzing group wise performance. In this, work different groups are made by means of final end semester result. In which student obtained above Group A (90 – 100 %), Group B (80 – 89 %), Group C (70 – 79 %), Group D (60 - 69%) and Group E (Less than 60%) were considered for undergone for this research work. Evaluation and analysis of student performance is considered in this research work based on the needed parameters. Assessment of student performance is considered by assigning weight age with respect to attributes from the student data sets.

Generally, in all education systems different types of evaluation patterns are introduced to evaluate student performance by means of semester wise, class room wise, location wise, subject wise and gender wise, practical lab exam, assignment, etc., All these evaluation patters and technique is considered to identify the students education standards.

4. RESULTS AND DISCUSSIONS

Automated data mining system with the integration of multi-agents systems detects new patterns from the identified database (student dataset) by detecting the new clusters automatically and provides the best quality of clusters. It is observed that the clusters obtained after quality process will be a good cluster and found to be useful for better decision making.

In figure 1, student performance is analyzed with respect to number of students during spring, fall and summer semester with respect to academic years. The academic year is scheduled as three semesters namely *semester_spring*, *semester_fall* and *semester_summer* in which, student who are all studying *semester_spring* are really good

in their studies when compared with other two semesters with irrespective to the students.

Some of most interesting patters are obtained while finding good clusters by deeper analysis. In this approach, correlation techniques is used by us to find out why semester _ spring students are quite good in their academic when compared to semester _ summer and semester _ fall [35]. The students who are belongs to semester _ spring have more number of lab exercise, assignment, case study, Quiz , end semester exam, etc is one of the added advantages while compared to other set of students. In some case, some of the groups belong to semester-summer; they were also performed well while compared with other groups in some other parameters like assignment, close book test, essay writing, assignment and presentation, etc.

In the above figure 2, correlation is made among different groups to evaluate their student performance in all subjects. With these, both positive and negative correlation links are generated with the help of link chart for better understanding and meaningful results so as to make better decisions. The positive correlation is denoted by blue color line and negative correlation is denoted by red color line which gives more added advantage to non-expert users.

In Figure 3, nearly 999 correlations were takes place to analyze the students performance ratio, in which the blue line are called as positive link where all the students from various groups performs well in all their examinations. The dark blue link line shows that students are stronger in their final examination while compared to other parameters.

In this above figure 4, both positive and negative links are found between percentage group-1 and percentage group-4. From these link charts, percentage group-1 student are not strong in final assessment parameter as well as close book test parameter. However, in the percentage group 4 more number of negative links is also reflected. It shows that students belongs to this group are not good in attendance and laboratory experiment parameters whereas they did their final examination very well while compared to other groups. The above link chart figure 5, shows all the negative link in all the groups which means that students perfomance are very poor in all set of groups Where as in figure 6,



shows the positive links mentioned that students from group-4 are more strong in that particular parameters only when compared to other parameters.

5. CONCLUSIONS AND FUTURE WORK

Automated data mining is an emerging concept in data processing [45][47]. In this research work, entire mining process is carried out by multi-agents with the help of automated system based on the user history. The major aim is to satisfy the user (less domain knowledge) expectation and interest. This research work mainly focused on automated mining process from which the suitable mining techniques are analyzed based on the data set and attribute nature by the data mining agents. Clusters are formulated and also a detection technique is used to analyze the quality of the cluster with respect to data base selected by the user agent on behalf of user. Thus, intelligent agent identifies whether new cluster is of good or bad quality cluster based on the user agent navigation, which is more meaningful for visualization. Visualization is based on the nature of the elements within the selected cluster (good / bad). This is because; clusters will never give meaning results, because of non domain experts when compared with domain experts. The domain experts will have more knowledge and easily understand the system within a short span of time. The solutions discussed in this research work regarding less domain user is more scalable and compatible when compared to the present existing systems by means of less attentions and more user friendly approach with the focused results. In this paper the link charts makes the less domain user more easy understanding by using this visualization methods instead of other visualization like graph, histogram, pie chart and etc,. Further this work is going to be extended with some more techniques related to visualization for less domain user so as to make them more as an expert data mining.

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RESUTLS AND GRAPHS

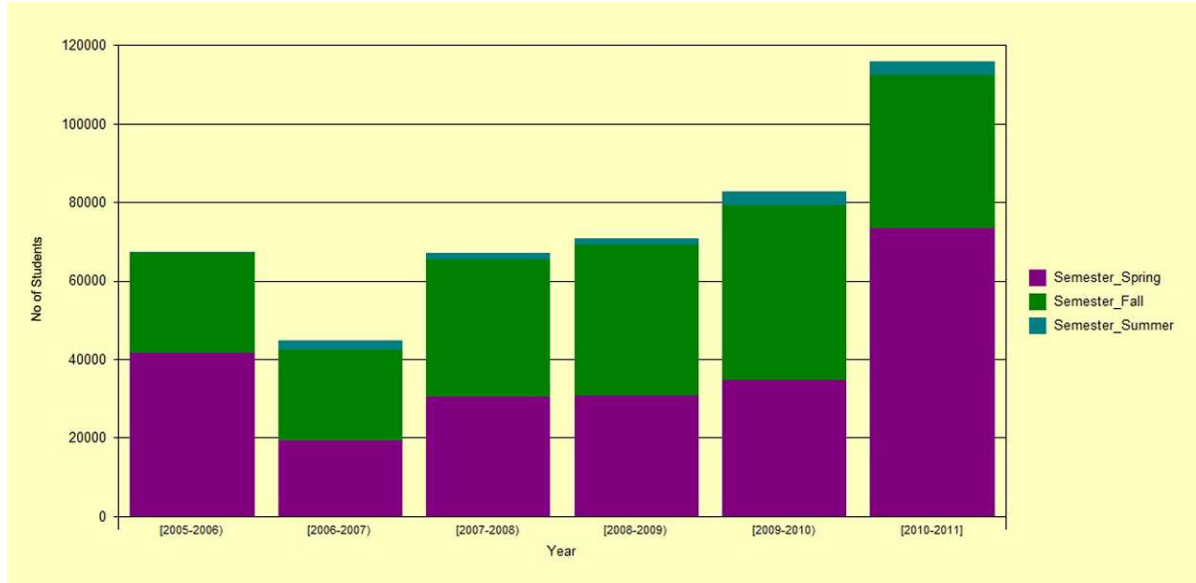


Figure 1: Students performance across semesters (X – axis: Year & Y – axis: No. of Student’s)

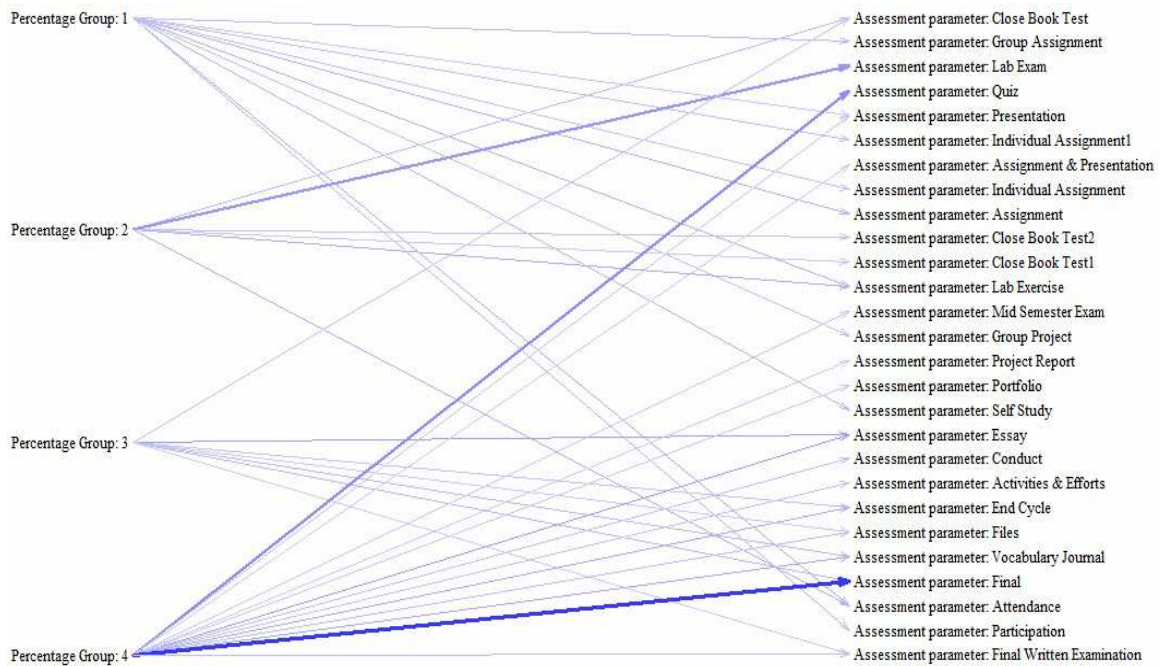


Figure 3: Correlation 999 All Links-Only Positive (Student’s are stronger in all subjects)

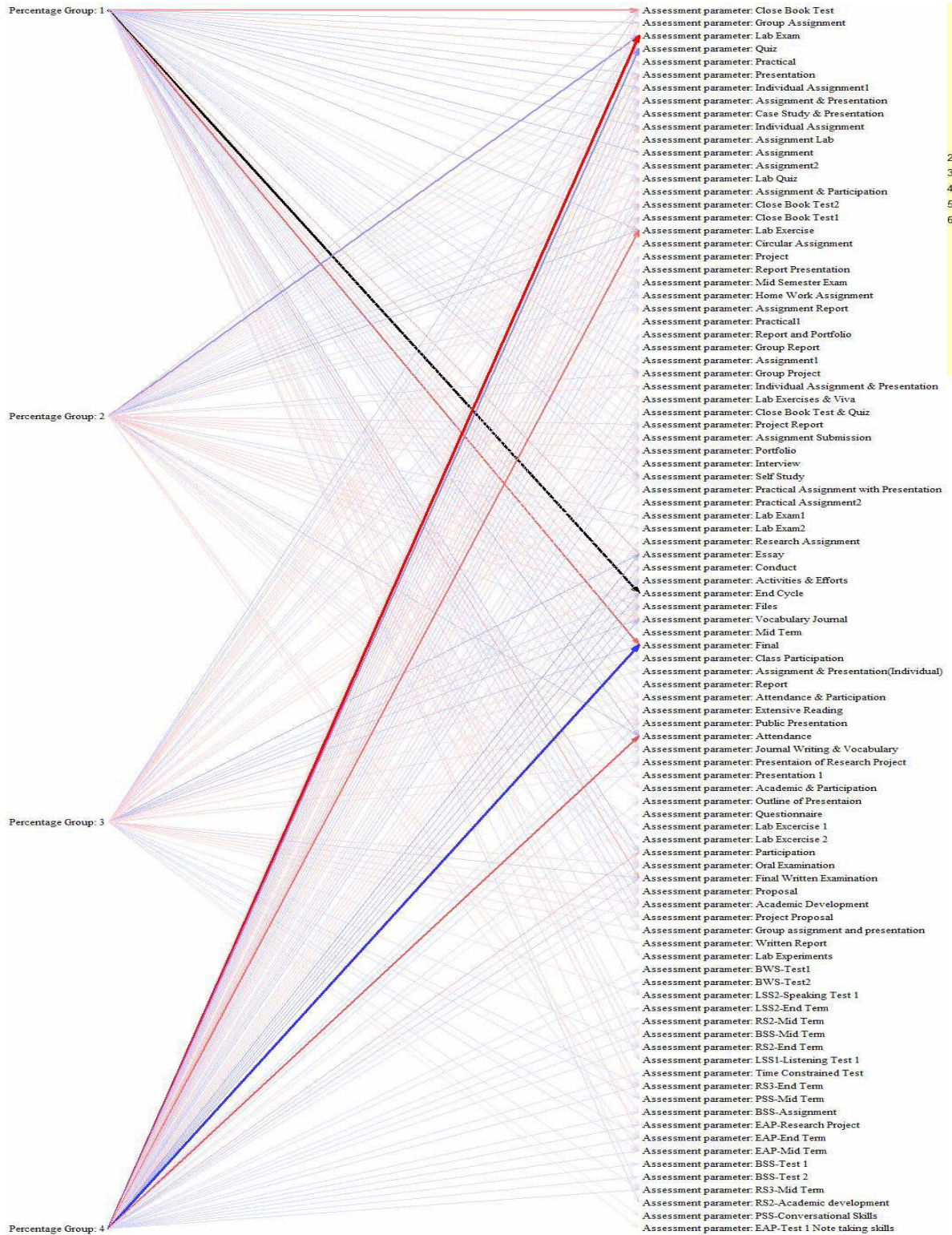


Figure 2: Link chart represent Correlation 108 All Links (Positive and Negative)
 (Student's are stronger in some parameters (Blue Line) but also weaker (Red Line) in some other parameters)

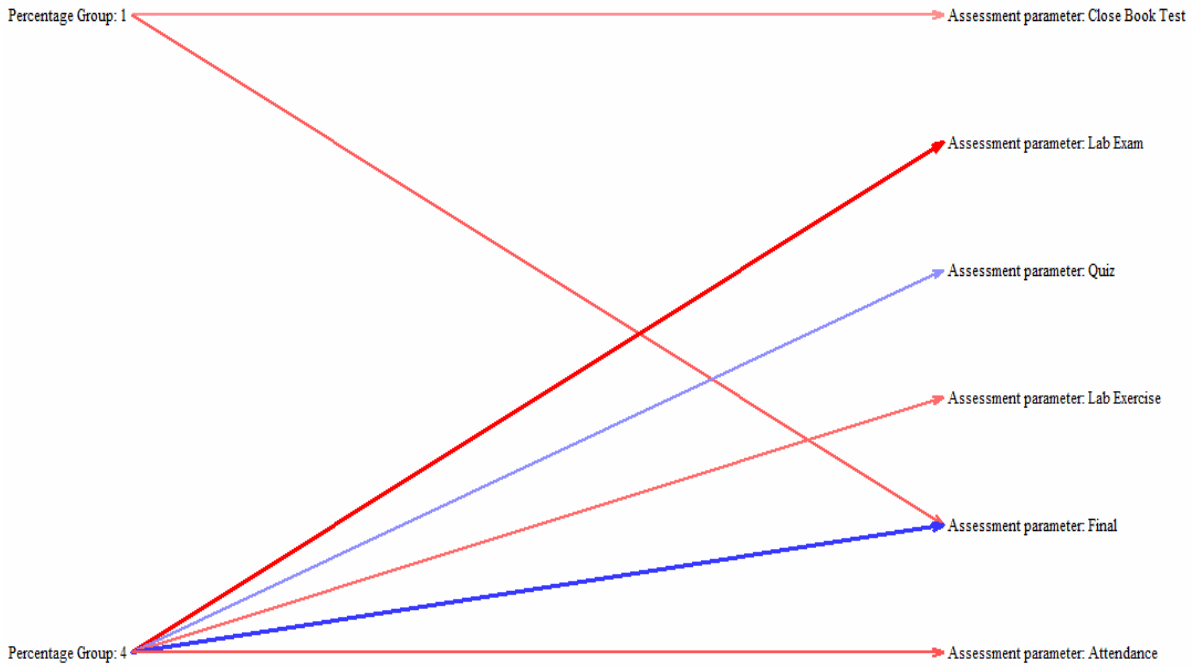


Figure 4: Correlation 999 All Links (Positive and Negative)
(Student's are weaker in major parameters and less strong in some parameters)

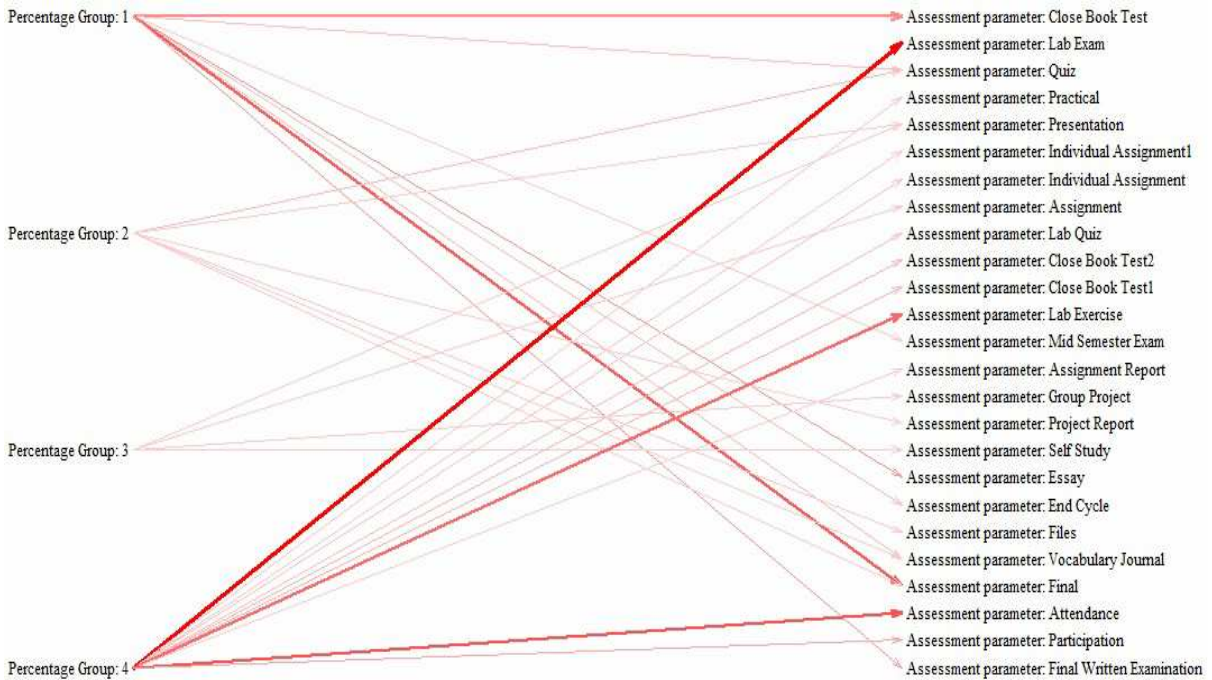


Figure 5: Correlation 243 All Links-Only Negative
(Student's are weaker in maximum number of parameters)

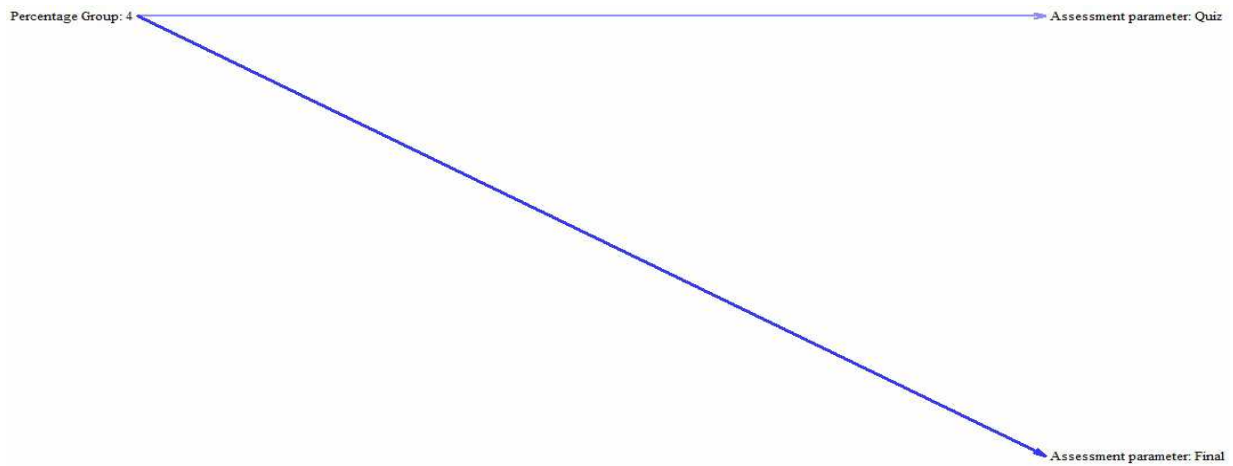


Figure 6: All Positive Correlation
(Student's are too stronger in certain parameters)