



The Visualization Analysis of Academic Papers Based on Knowledge Atlas

—A Case Study of Zhejiang Open University

Yue Ying

Department of Personnel, Zhejiang Radio and Television University, Hangzhou, China

Email: 88822392@163.com

How to cite this paper: Ying, Y. (2017) The Visualization Analysis of Academic Papers Based on Knowledge Atlas. *Open Access Library Journal*, 4: e3499. <https://doi.org/10.4236/oalib.1103499>

Received: March 6, 2017

Accepted: April 15, 2017

Published: April 19, 2017

Copyright © 2017 by author and Open Access Library Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

The citation analysis methods, based on knowledge atlas and social network, which have been already applied in the academic research fields are getting more and more widespread. This paper combines the method of content analysis with the one of information visualization, and uses the analysis method based on concurrence matrix knowledge atlas and social network through analyzing the research directions, the academic community relationships, the foreign cooperated relationships, etc. on the academic papers in Zhejiang Open University system in recent 10 years. And then this paper also finds out the problems in the scientific research by multi-dimensional scaling analysis and clustering results. Therefore, the author gives some suggestions on how Zhejiang Open University focuses its scientific research orientation in future.

Subject Areas

Education

Keywords

Knowledge Atlas, Social Network Analysis, Academic Paper, Scientific Research, Open University

1. Introduction

A university's development orientation and innovation level are reflected in some aspects by the research direction and capacities of scientific research of its teachers. As the country's largest distance higher education system, Radio and TV university in China has formed a complete set of scientific research system in the area of scientific research for many years, has trained a large number of ad-

vanced scientific researchers, also has achieved a lot of high quality research findings, mainly in the form of academic papers.

Zhejiang Radio & TV University (ZJTVU) is a modern distance and open university, characterized by open education as its subject, together with diversified modes of running open universities and coordinated development of various types of education. Taking advantage of modern information technologies and distance education network, by means of a wide range of academic and non-academic continuing education, ZJTVU has set the goal of establishing a lifelong learning system and a learning-oriented society. Laying emphasis on the promotion of teachers' scientific research ability and quality over the years, ZJTVU has been in the leading place in the output of scientific research in the national radio and television university system.

According to the CNKI statistics of academic papers published in national TV university system by Wei Shunping in China in 2010, ZJTVU tops as the third in China, with the first and second place of Jiangsu TV University & Guangdong TV University respectively [1].

Once again in April 2016, the author has made the CNKI statistics of academic papers in TV university system, which reveals the top three branches of Jiangsu TV University, ZJTVU, and Guangdong Open University. As a matter of fact, it is now the routine work for the scientific research management of ZJTVU to analyze those published academic papers on a statistical basis, with the purpose to orient the academic research, find out academic group network relationship, and dynamically analyze scientific research [2].

Recently, citation analysis based on Knowledge atlas and social network analysis is getting more and more general applied [3] [4]. Combining information visualization techniques, graphics and applied mathematics with citation co-occurrence analysis method in metrology, knowledge atlas analysis exhibits the history of development, the academic community relationships, and advanced academic research, as well as the knowledge structure of overall network in document research by using visual maps. Social network analysis research is regarded as the most convincing, concise and explicit empirical research method to analyze social structure, which is fairly potential in educational academic research [5].

2. Research Process and Method

Selecting CNKI periodical full-text database, the national largest journal full-text database, as the data source, this paper combines the method of content analysis with information visualization, and uses the analysis method based on concurrence matrix knowledge atlas and social network through analyzing the research directions, the academic community relationships, the foreign cooperated relationships, etc. on the academic papers in Zhejiang Open University system in recent 10 years. Meanwhile, according to university's development orientation, the paper gives some guidance and suggestions on how Zhejiang Open University develop its scientific research orientation in future. Tools used in the research process include BICOMB (bibliography co-occurrence analysis system),

CiteSpaceIII (information visualization statistical software), UCINET6 (social network analysis software), and SPSS20.0 (statistical analysis software).

Based on the characteristics of distance higher education of radio and television university, most high quality education academic papers have been published in such kinds of educational core journals as “Journal of Distance Education” “Modern Educational Technology” “China Educational Technology” “E-education Research” “Distance Education In China” “Distance Education in China” “Open Education Research” “Modern Distance Education”. Those representative papers of distance and open education of the core journals published papers have been analyzed. With the retrieving date from January 1, 2006 to April 15, 2016, the retrieving statement of “AF%” ZJTVU, this study search those papers published in the mentioned seven journals. Journal citations information includes author, unit, title, keywords, etc. Information retrieval results mainly contains main information such as the title, keywords, institutions and authors.

3. Data Statistics and Analysis

3.1. Ratio Statistics of Core Journal Paper

According to statistical source mentioned in this paper, in nearly a decade, a total of 2241 papers, including 192 core journal papers, have been published in ZJTVU. The total number of the published papers, number of core journals papers and core periodical paper ratio of details are shown in **Table 1**. As we can see, the total number of papers published annually from 2008 to 2016 shows a decreasing trend. Although there is not so much changes to the number of core journals published papers from 2007, but the proportion in the total number of papers is “just on the rise, which means better quality for the paper published by ZJTVU. “Journal of Distance Education”, sponsored by ZJTVU, has enjoyed a steady improvement in journal quality since its promotion to CSSCI source journal in 2007. Since then, there has been a significant decrease of the paper

Table 1. The total number of papers published in recent years.

Year	number of papers published	number of core papers published	proportion
2006	228	35	15.35%
2007	256	20	7.81%
2008	302	18	5.96%
2009	271	18	6.64%
2010	224	16	7.14%
2011	211	14	6.64%
2012	209	14	6.70%
2013	192	15	7.81%
2014	181	20	11.05%
2015	146	14	9.59%
2016	21	5	23.81%
totally	2241	189	8.43%

published by our own teachers of ZJTVU. Instead, the journal has issued more and more papers by authors of common colleges and universities, which is similar to the counterparts sponsored by other TV Universities. In that case, the quality of paper by teachers in ZJTVU would be greatly improved.

3.2. High Frequency Keywords Co-Occurrence Matrix Building

The overall scientific research development and research direction can be learned by analyzing the literature keywords.

Therefore, on a basis of keywords extraction, frequency statistics, the co-occurrence matrix building of educational core journal papers published by ZJTVU, this paper demonstrates the scientific research of ZJTVU in a decade by not only clustering and multidimensional scaling analysis, but also presenting it in different ways to analyze the literature statistics.

(1) Build high frequency keywords frequency statistics and matrix

In order to avoid distraction of those inadequate information to subsequent multidimensional and cluster analysis, this study carried out data cleaning processing before extracting high frequency keywords, which presented as to remove non-conforming records in the exported sources, including detecting and eliminating duplicate records, merging schematically similar keywords, as well as removing non-academic articles such as publicity documents, etc. On this basis, statistical analysis are made with BICOMB software to high frequency keywords of educational core thesis of ZJTVU in nearly a decade, as shown in **Table 2**. Statistical results reveal that the research emphasis of TV universities lies in distance education, open education, online learning. In addition to that, with the development of information technology, various education technologies such as mobile learning, flipped classroom, big data research appear constantly.

Based on the frequency statistics, this study has built high frequency keywords co-occurrence matrix by selecting top 25 high frequency keywords with BICOMB software.

(2) Construct high frequency keywords co-occurrence network knowledge CiteSpace, a currently widespread literature analysis tool of building network

Table 2. High frequency keyword.

keyword	frequency	keyword	frequency
Distance education	55	Network learning	9
Open education	30	Teaching method	8
Distance & Open education	18	Local TV University	8
Open university	16	Association	7
Modern distance education	15	Mobile learning	7
Solution	12	Flipped classroom	6
TV University	9	Big data	5
Lifelong learning	9		

knowledge graph, firstly imports the literature resources data rinsed, then with the function of building network knowledge map, generates keywords network knowledge map, as shown in **Figure 1**.

As we can see from the figure, ZJTVU has formed its key research areas in the research process for so many years, such as “open education”, “online learning”, “Open University”, “community education” and “lifelong learning”. For example, “open education” focused research includes such keywords as “online learning”, “modern distance education”, and “teaching mode”. Keyword co-occurrence network diagram clearly reveals research focus and research direction of ZJTVU in a decade. In order to further understand the research direction of it evolution in recent years, through the Timezone visualization function of CiteSpace tool, this study shows previous keyword variation in the recent ten years, as shown in **Figure 2**.

As we can tell from **Figure 2**, before 2009, ZJTVU researchers basically paid

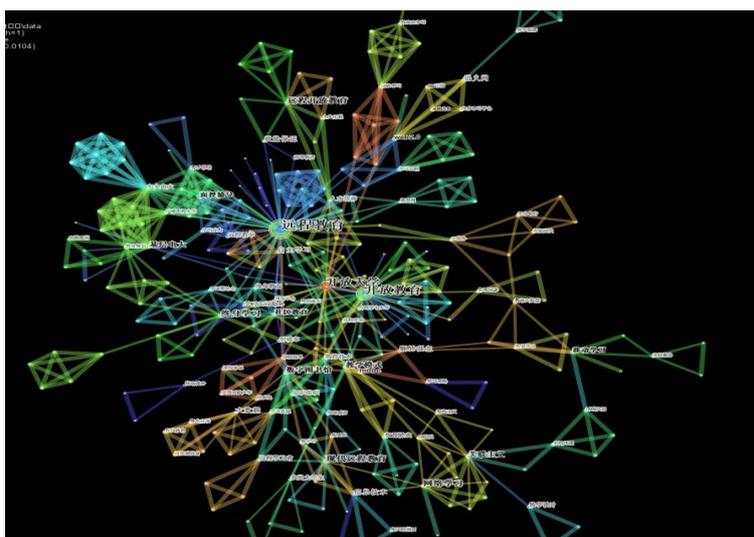


Figure 1. Keywords network knowledge map.

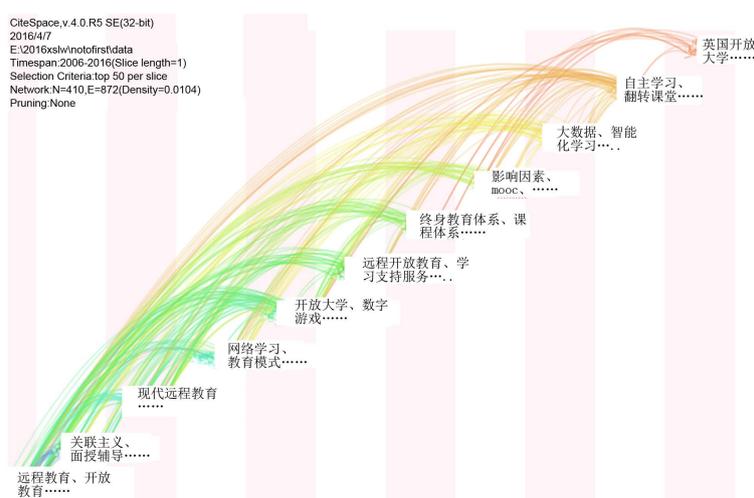


Figure 2. Previous keyword variation.

close attention to all kinds of research, with priority in distance education and open education. Since 2010, they have advocated the theory and practice study of educational technology, such as the educational application of MOOCs, flipped classroom, big data applications in education research. There is also a very significant change, that is, a certain percentage of the related research focusing on Open University.

ZJTVU has laid its emphasis on the construction of Open University in recent years, with its theoretical research started as early as in 2010. At present, promoted by related policies of the Ministry of Education, ZJTVU is going all out to speed up the process of construction of Open University, which is not only career pursuits, but also social responsibilities. What ZJTVU needs is to integrate the most advanced educational concept with educational technology, and to serve the construction of a learning society. **Figure 3** shows the keyword network relationship focusing on “Open University”.

As shown, what associates with “Open University” focused research includes “talent cultivation”, “social responsibility”, and “lifelong learning”, “open education”, “social education”, “service learning”, “cooperation learning”, “cooperative study”, “social responsibility”, “education modernization”, “hybrid teaching”, “flipped classroom”, “MOOCs”, “SPOC” and “curriculum reform”, “Chinese dream” and so on.

For more intuitive solutions in the research situation, a quotation record line chart has been made through CiteSpace software rendering with “Open University” as the core keyword, as shown in **Figure 4**. Reviewing the construction of Open University, although ZJTVU began its process of research and practice from 10 years ago, it remains little in the number of academic papers published. Therefore, scientific research should keep the step with the transformation and positioning of school development. Furthermore, ZJTVU should also continue to offer guidance to teachers, as to strengthen the research in this field.

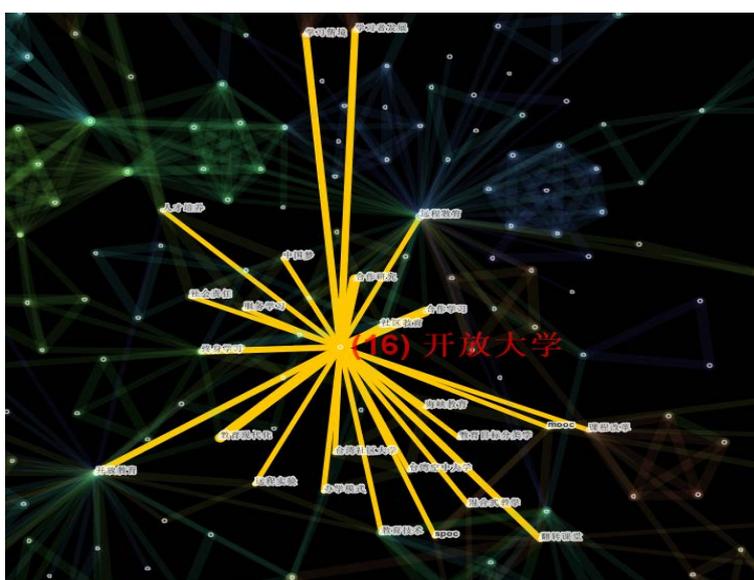


Figure 3. Keyword network relationship focusing on “Open University”.

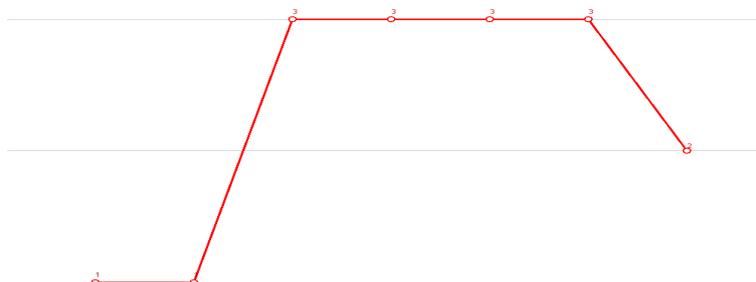


Figure 4. Citation history of Open University.

3.3. Clustering and Multidimensional Analysis of High Frequency Keywords

On the basis of the co-occurrence matrix, clustering analysis was carried out to the key words, which can show more clearly the analysis process and results. Thus, we import the high frequency keywords co-occurrence matrix into SPSS, and then carry on clustering and multidimensional scaling analysis. Clustering analysis can reflect keywords relationship. By clustering closely related words together into a category, research hotspot and classification would be observed. Choosing Ward clustering, the clustering result is shown in **Figure 5**. According to the **Figure 5**, clustering result can be divided into three categories. The first category includes keywords based on distance education, such as “radio and television universities” (regional TV university and central TV university), “distance education”, “learning process”, “face-to-face tutorial” and so on. The second category mainly include keywords like “lifelong learning”, “social education”, “Open University” and other words. There are more keywords of the third category, including such educational technology keywords in research fields as “online learning”, “mobile learning”, “educational technology”, “association”, “digital library”, “modern distance education” .

In order to get the further research direction and classification results, this study chooses the ALSCAL as the analysis method. At the same time, it refers to high frequency keywords co-citation matrix to conduct the multidimensional scaling analysis. Multidimensional Scaling (MDS), based on the similarity or distance between objects of studies, is a kind of graphic method which displays objects of studies vividly in a low dimensional (two-dimensional or three-dimensional) space to make cluster analysis or dimensional analysis. The spatial location map, which is presented by multidimensional scaling analysis, can illustrate the correlative relationship among the research objects simply and clearly. Through setting and analysis of related parameters, the analysis results of stress, the pressure index, values 0.08739, RSQ values 0.9910. According to the principle of multidimensional scaling analysis, it is generally believed that stress value is lower than 0.2, close to 0.05 as a desirable situation, RSQ value close to 1 is preferred. Therefore, model imitative effect is quite satisfactory. Two-dimensional coordinate atlas for high frequency keywords are shown in **Figure 6**.

According to the two-dimensional figure multidimensional scaling analysis,

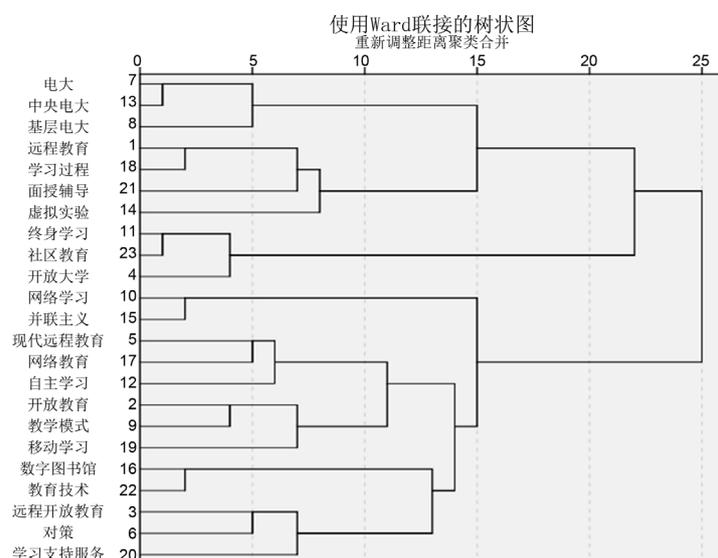


Figure 5. Analysis chart of high frequency keywords.

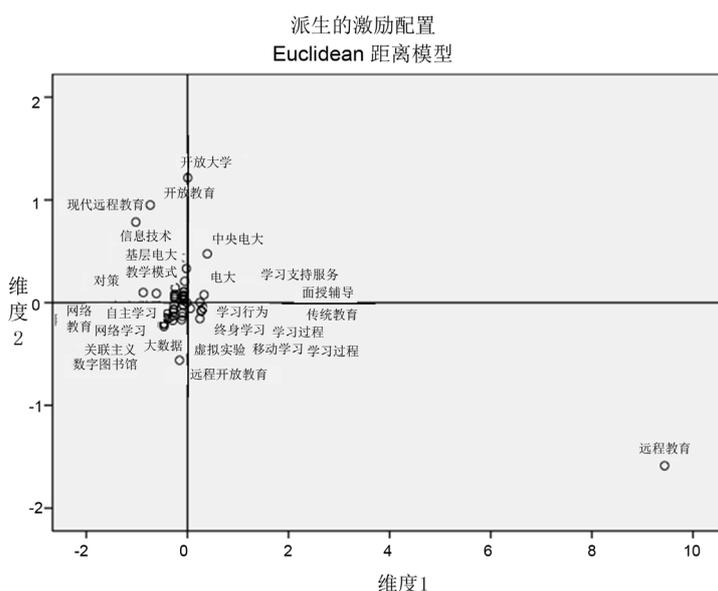


Figure 6. Two-dimensional coordinate atlas for high frequency keywords.

combined with the clustering analysis, ZJTVU's research in the recent 10 years can be divided into four categories:

The first category is the study on teaching and management with the characteristics of radio and television university, which is clustered by keywords of “TV university”, “local TV university”, “the central radio and television university”, “learning support services”, “face-to-face tutorials” and “learning process” .

The second category refers to educational technology research. Education technology research mainly involves application research of distance education technology, including keywords such as information technology, network education, association, big data, data library, and virtual laboratory clustering.

Third class is the research on the construction of Open University, which

clusters in the research field of lifelong learning, community education and traditional education.

The fourth category refers to research on distance and open education, with distance education and open education as its key issue. Since word processing has been made to words similar to open and distance education in the process of word frequency statistics, the frequency of two keywords “distance education” and “open education” is much higher than other keywords. Therefore, word frequency statistics reveals that open education and distance education occupy the largest proportion of the academic research in the whole radio and television university system.

4. Conclusions

The application of citation analysis methods based on knowledge atlas and social network analysis in academic research field has been universally accepted and welcomed by the academia. Combining the analysis methods of paper content with information visualization, together with the analysis methods based on knowledge atlas and social network, this study analyzes research direction of papers issued by ZJTVU in the past decade, and discusses academic community and foreign cooperated relationships. Besides, it also finds out existing problems in current academic research and puts forwards suggestions on academic research according to developmental orientation of ZJTVU.

As can be seen from the above analysis, ZJTVU has a wide range of research in the field of distance and open education. In a macroscopic view, there are not many changes to all kinds of research mainly focusing on distance education and open education in nearly a decade, which also accord with the characteristics of radio and television university itself. In a micro point of view, on the contrast, it has formed the core research area such as “lifelong learning”, “Open University”, and “learning support services”. Meanwhile, every field has a number of relatively fixed term keywords. Through the above analysis, combined with the current school development and positioning, ZJTVU should pay attention to the following aspects in the area of scientific research.

ZJTVU should continue to strengthen research on the construction of Open University and credit bank. It proposes explicitly in the national plan of the 13th Five-Year that we should promote to share open learning resources, to establish Open University, to develop online education and distance education, as well as to integrate all kinds of digital education resources to service the whole society. At the same time, it is advocated to build system of personal learning account and credits accumulated, to promote continuing education and lifelong learning channels, to develop national qualifications framework, to promote non-academic education learning outcomes, to transfer mutual recognition of credits for professional skill level. Driven by both social demands and national policy, the construction of Open University has become the main solution to transform and develop TV university. In the next few years, the research areas focusing on Open University should be strengthened and encouraged.

On the one hand, lack of research in credit bank field resulted as its lagging scientific research outputs; at the same time, research literature of credit bank has not been published in the journal before. The construction of a lifelong education credits bank is not only a priority of Zhejiang Open University, but also an important construction project in the 13th Five-Year plan of Zhejiang Province Education Department. Construction of Credit bank should gradually reveal its importance from the policies and requirements, from the state to the provinces. Scientific research departments of TV university should properly guide relevant professionals to strengthen academic research in this field.

Strengthen the research on leading educational theory and practice. Compared with the current cutting-edge research of educational technology, radio and television university still has a lot of research vacancies in wisdom education, electronic schoolbag, a guest education, learning analysis technology and so on. Those currently popular research does not appear in the high frequency keywords, some even does not appear in the journal. As we all know, the construction of Open University is to better serve the whole society, and to provide more high-quality learning resources in a kind of brand-new education idea and service mode. In order to achieve this goal, supported by advanced educational technology and learning theory, the TV university needs to continue to strengthen research and study, apply technology development to TV university system construction.

ZJTVU should further enhance external scientific research cooperation. It is found from institutional cooperation network analysis that most of TV universities' cooperation is based on systemic internal cooperation, lack of external cooperation. The construction of Open University has put forward clear direction for TV university development, namely broad services to universal education, lifelong education and learning society construction, resulting in the promotion of educational equality. In scientific research, therefore, ZJTVU also needs to strengthen external cooperation with an open mind. By using social resources and drawing lessons from others, ZJTVU will finally improve its scientific research level.

References

- [1] Wei, S.P. (2011) Research Achievements Survey and Analysis of national TV Universities in 2010. *Journal of Tianjing TV University*, No. 3, 21-25.
- [2] Zhang, S.Q., Zhang, W.L. and Li, B. (2016) Current Situation and Development Trend of Deep Learning Abroad in the Recent Ten Years. *Journal of Distance Education*, No. 2, 64-71.
- [3] Mou, Z.J. and Yu, X. (2016) Academic Group and Hot Issues Tracking of Learning Analysis Based on Atlas Analysis. *Journal of Distance Education*, No. 2, 54-61.
- [4] Wei, S.P. (2010) Research Status and Trend of Foreign Educational Technology—Based on the Analysis of Journal Articles on Foreign Educational Technology Research. *Open Education Research*, No. 2, 82-89.
- [5] Zhong, B.C. and Li, Y. (2013) The Application of Social Network Analysis in the Field of Education Research Based on the Education Core Journals. *Education Research*, No. 9, 25-32.



Submit or recommend next manuscript to OALib Journal and we will provide best service for you:

- Publication frequency: Monthly
- 9 [subject areas](#) of science, technology and medicine
- Fair and rigorous peer-review system
- Fast publication process
- Article promotion in various social networking sites (LinkedIn, Facebook, Twitter, etc.)
- Maximum dissemination of your research work

Submit Your Paper Online: [Click Here to Submit](#)

Or Contact service@oalib.com