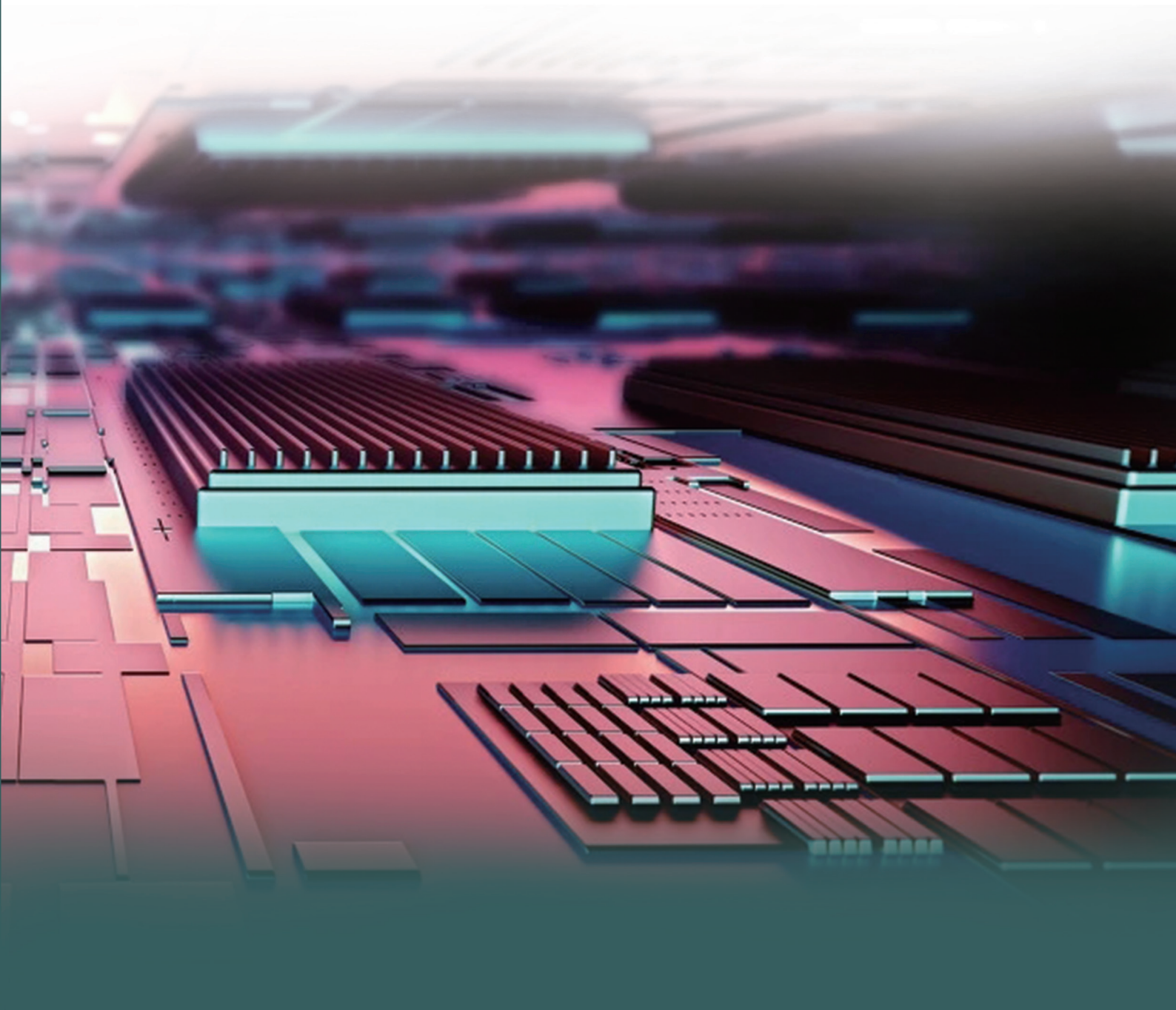
SYNERGY
PUBLISHING PTE. LTD.

Volume 6
Issue 02
October 2022

ISSN 2591-7110(Print) 2591-7129(Online)

Modern Electronic Technology



SYNERGY
PUBLISHING PTE. LTD.

Modern Electronic Technology

Aims and Scope

Modern Electronic Technology (MET) is an open access, peer-reviewed scholarly journal which aims to publish original research articles, reviews and short communications that covers all area of electronic engineering technology. MET emphasizes on publishing high quality papers, as well as aims to provide a source of information and discussion platform for engineers, researchers, and electronic professionals worldwide.

Subject areas suitable for publication include, but are not limited to the following fields:

- Microelectronics
- Nanoelectronics
- Electronic Materials Technology
- Structure and Nature of Semiconductor
- Digital Technology
- Automation System

Publishing Cycle

Quarterly

Journal Homepage

http://ojs.s-p.sg/index.php/met

Key Features

- Open Access
- High Academic Level Editorial Board
- Easy and Fast Submissions
- Double Blind Peer Review
- Rapid Online Publication of Articles upon Acceptance
- Outlet for Academic Institutions and Industry

SYNERGY PUBLISHING PTE. LTD.

Volume 6 Issue 2 · October2022
ISSN 2591-7110 (Print) ISSN 2591-7129 (Online)

Synergy Publishing Pte.Ltd.

E-Mail: contact@s-p.sg
Official Website: www.s-p.sg
Address: 12 Eu Tong Sen Street, #07-169, Singapore 059819

CONTENTS

SYNERGY PUBLISHING PTE. LTD.

Modern Electronic Technology

http://www.advmodoncolres.sg/index.php/amor/index

3D Reconstruction and Animation of Brain MRI Images Based on Matlab

Hong Dai*

School of Computer and Information Engineering, Shanghai Second Polytechnic University, Shanghai, 201209, China

ARTICLE INFO

Article history
Received: 10 June 2022
Revised: 27 June 2022
Accepted: 15 September 2022
Published Online: 16 October 2022

Keywords:
Matlab
3D reconsruction
3D rotation transformation
Animation

ABSTRACT

The following algorithms are proposed and realized by MATLAB programming based on the brain MRI images: (1) The 3D surface of the brain is reconstructed using MC algorithm. (2) A rotate animation of the brain is created and displayed by 3D rotate transformation and animation functions of Matlab. Result shows that the algorithm can show the brain accurately and quickly, takes up less space in memory.

1. Introduction

Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) techniques have been widely used in disease diagnosis, but these imaging methods can only provide two-dimensional images of the human body. Recently, 3D visualization technology has become a research hotspot in medical image processing. This technique can extract the three-dimensional structural information of human tissue from the tomographic image sequence, which plays an important role in assisting diagnosis, surgical simulation and guiding treatment. MATLAB is a mathematical software produced by MathWorks, a powerful, for algorithm development and data analysis in almost all engineering fields, and easy to program, easy to learn and use.

This paper realizes the 3D reconstruction of the brain MRI image and generates the rotation animation, which can be applied to the computer-aided teaching system in the field of brain disease diagnosis and medicine.

2. 3D Reconstruction of Brain MRI Images

The Marching Cubes (MC) algorithm was used to draw the 3D reconstruction of the brain MRI images. The basic idea is [1]: The "equivalent surface" of each voxel is extracted from the information on the surface characteristics of the object, which constitutes the 3-dimensional surface of the object. The steps are as follows:

(1) Equivalent Extraction

The brain image sequences are sequential superimposed into a three-dimensional bulk dataset f (x, y, z), and

**Corresponding Author:*
Hong Dai,
School of Computer and Information Engineering, Shanghai Second Polytechnic University, Shanghai, 201209, China;
Email: daihong419@163.com

 DOI: https://doi.org/10.26549/met.v6i2.11434

the "equivalent" actually means a surface in space where f (x, y, z) is equal to the threshold k [4]:

$$f(x, y, z)=k \quad (1)$$

where k is the threshold. The k takes the threshold when dividing the brain image, k =20. To produce a smooth surface, the dataset was smoothed with a Gaussian low-pass filter before extraction.

(2) Lighting Effect Settings

Light effects were set up using the phong model.

3. Brain Rotation Animation Display

In order to observe the brain structure from all directions, the reconstructed results can be transformed in 3D rotation and animated for display [5]. The basic idea is that the graph is rotated in three dimensions, and its structure does not deform because the isosurface connection mode is unchanged. The brain graph is rotated around its centroid and displayed as follows:

(1) Move the centroid of the graph to the origin. The homogeneous transformation matrix [2] is:

$$\boldsymbol{T}_1=\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -x_g & -y_g & -z_g & 1 \end{bmatrix} \quad (2)$$

among $\mathbf{x}_g=\frac{\sum_{i=1}^{n} x_i}{N}$, $y_g=\frac{\sum_{i=1}^{n} y_i}{N}$, $z_g=\frac{\sum_{i=1}^{n} z_i}{N}$, N--Total number of pixels in the dataset;

(x_i, y_i, z_i) - Coordinates of the pixel i in the dataset.

(2) Compared with the origin (i.e., the center of mass), the rotation transformation matrix is:

$$\boldsymbol{T_2=R_X R_Y R_Z} \quad (3)$$

$$\textbf{among } \mathbf{R}_X=\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\alpha & \sin\alpha & 0 \\ 0 & -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix},$$

$$\mathrm{R}_Y=\begin{bmatrix} \cos\beta & 0 & -\sin\beta & 0 \\ 0 & 1 & 0 & 0 \\ \sin\beta & 0 & \cos\beta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}, \quad \mathrm{R}_Z=\begin{bmatrix} \cos r & \sin r & 0 & 0 \\ -\sin r & \cos r & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

α ,β, γ are the angles of the graph rotate around the X, Y and Z axes respectively.

(3) Move the centroid to the original position. The transformation matrix is:

$$\boldsymbol{T_3}=\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ x_g & y_g & z_g & 1 \end{bmatrix} \quad (4)$$

Considering the above three steps, the transformation matrix of the brain graph rotating around its own center of mass is:

$$\boldsymbol{T= T_1 \bullet T_2 \bullet T_3} \quad (5)$$

Let any point on the drawing (x, y, z) rotate around the center of mass be (x_1, y_1, z_1), Then

$$[x_1, y_1, z_1, 1]=[x, y, z, 1] \bullet \boldsymbol{T} \quad (6)$$

(4) Animated Display and Storage

Set brain graphics from the original position, each time with its center of mass as the origin,

rotate △ α, △ β, △ γ around X, Y, Z axis respectively, and store the picture as a frame of the animation file, display the current graphics while erase the previous graphics, total rotate 360 degrees to produce animation effect [3], finally put all the images in the avi format animation file.

4. Matlab Program of This Method

Programming environment: Matlab2007. Experimental data source: matlab's own brain MRI image sequence: "MRI". 3D reconstruction and rotation animation display program of the brain is as follows(brainavi.m) :

```
% brainavi.m
clear       % clear memory
clc         %clear the screen
Figwin=figure ('position', [50 50 450 450], 'Name',
'Brain 3 D reconstruction and rotation animation demonstration', 'NumberTitle', 'off', 'Menubar', 'none');
% Generates a graphical window titled "Brain 3D reconstruction and rotation animation demonstration"
%%%%1.Read-in brain MRI images%%%%%
load mri        % Brain MRI image data are loaded into computer
D=squeeze (D);  % convert D from 4 to 3 dimensions
Ds=smooth3 (D); % uses a Gaussian low-pass filter to smooth D,create Ds
%%%%2. 3D reconstruction with rotation animation of the brain%%%%
fv=isosurface(Ds,20);
% Brain isosurface was extracted with threshold k=20, shown in formula (1).The fv is a structural array, where fv.vertices is the vertices is the vertex information for the graph; the fv.faces is the surface information for the graph.
fv2=isocaps (D, 5);    % Extraction of the upper brain cap, threshold k=5
yuan=fv.vertices;      % Make yuan is the vertex information of the original brain graph
yuan2=fv2.vertices;    % Make yuan2 is the vertex information of the original brain graph
N=length (yuan);       %N and N2 are the number of pixels
```


DOI: https://doi.org/10.26549/met.v6i2.11434

```
of yuan and yuan2, respectively
N2=length(yuan2);
xg=sum(yuan(:,1))/N;
yg=sum(yuan(:,2))/N;
zg=sum(yuan(:,3))/N;
xg2=sum(yuan2(:,1))/N2;
yg2=sum(yuan2(:,2))/N2;
zg2=sum(yuan2(:,3))/N2;
% For the centroid of yuan and yuan2, see formula (2)
T1=[1 0 0 0;0 1 0 0;0 0 1 0;-xg -yg -zg 1];
T3=[1 0 0 0;0 1 0 0;0 0 1 0;xg yg zg 1];
T12=[1 0 0 0;0 1 0 0;0 0 1 0;-xg2 -yg2 -zg2 1];
T32=[1 0 0 0;0 1 0 0;0 0 1 0;xg2 yg2 zg2 1];
%3D T3 in T 3 rotation matrix, see Equations (2), (4)
M=24;     % Number of animated screen, M=24
mov=avifile('brainRotate.The avi');
% Create the brain rotation animation file 'brainRotate.
avi'
for j=1: M  % produces, displays, and saves brain rotation
animation
xian=0;
xian2=0;
% Initialization of x i a n and xian2.The Xian and xian2
are the animated images after each rotation of yuan and
yuan2, respectively.
th=2 * pi / M * j;   % Angle th for each rotation around the
Z axis.
A = 0;              % Angle A for each rotation around the
X-axis.
b=0;          % b for each rotation around the Y axis.
Rx=[1 0 0 0;0 cos(a) sin(a) 0;0 -sin(a) cos(a) 0;0 0 0 1];
Ry=[cos(b) 0 -sin(b) 0;0 1 0 0;sin(b) 0 cos(b) 0;0 0 0 1];
Rz=[cos(th) sin(th) 0 0;-sin(th) cos(th) 0 0;0 0 1 0;0 0 0
1];
T2=Rx * Ry * Rz;%3D rotation T2, see formula (3)
T=T1 * T2 * T3;
% Brain graphics and top cover transformation matrices
T and TT rotating around the own center of mass, see for-
mula (5)
TT=T12*T2*T32;
The xian= [yuan ones (N, 1)] * T;
% 3D rotation transformation of brain graphics and upper
cover, see formula (6)
xian2=[yuan2 ones(N2,1)]*T;
The xian=xian (:, 1:3);
% the brain rotates 360 degrees around its centroid in par-
allel to the z-axis (24 frames in total)
The xian2=xian2 (:, 1:3);
% brain cap rotates 360 degrees in the direction parallel to
the z axis (24 frames)
daspect([1,1,0.4]);view(3)
patch('Vertices',xian, 'Faces',fv.faces,'Facecolor',[1,0.75,
0.65],'EdgeColor','none');hold on;
patch('Vertices',xian2, 'Faces',fv2.faces,'FaceColor',[1,0.
75,0.65],'EdgeColor','none');hold on;
% 3D reconstruction of the brain and its upper cover.The
vertex is the xian and xian2 that have passed the 3D rota-
tion, while the surface information is still the fv.The faces
with fv2.faces, and set the graphic surface color with the
edge color.
lightangle (th, 30); lighting phong;  % lighting with phone
model
xlabel ('x'); ylabel ('y'); zlabel ('z');  % displays the X, Y,
and Z axes
F=getframe;              % produces a frame of animation
mov=addframe (mov, F);       % Add the animation frame
F to the animation file mov
name=strcat('a',num2str(j));
print('-dtiff',name);
% Save each frame of the animation with the name aj.In
the image file for the tif (j=1~24)
   if j~=M + 1              % will erase the image from the
previous frame
   delete(gca);
   end
   end
aviobj1=close (mov);          % Display is finished, close
the animation file
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

5. Graph of the Experimental Results

Display the brain MRI image sequence "MRI" (27 images in total) brought by the matlab by using the above procedure, where the rotation parameters are set in Table 1:

Table 1. Rotation parameter setting for the brain animation

The frame number of the animation	Total rotation Angle	Δα	Δβ	Δγ
24	360°	0°	0°	15°

The 3D reconstruction results of the MC algorithm are shown in Figure 1, and the frames of the rotation animation are shown in Figure 2(a) ~ (e).

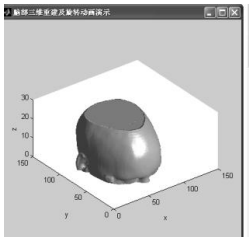
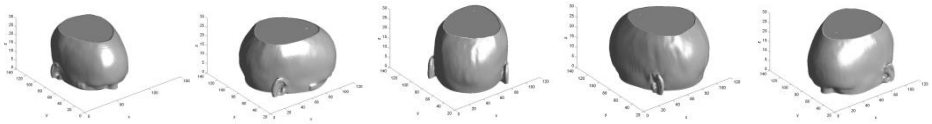


Figure 1. 3D Reconstruction of the Brain MRI Images

 DOI: https://doi.org/10.26549/met.v6i2.11434



(a) (b) (c) (d) (e)

Figure 2. Frames 1, 5, 10, 15, 20 of the Brain Rotation Animation

The total time for brain 3D reconstruction, animation and generation, display and preservation by using the above algorithm is 19.75 s, and the animation file size is 126 k bytes.

6. Conclusions

This paper proposes a 3D reconstruction and animation display algorithm, which is implemented by matlab software programming. The experimental results show that the method can display the brain comprehensively, and run quickly and occupy small memory space. Using this algorithm and image segmentation technology allows 3D visualization of all tissues of organs in human body.

References

[1] Tian, J., Zhao, M.Ch., He, H.G., 2004. Theory and Practice. Beijing: Tsinghua University Press.

[2] Cheng, S.Y., Zhang, Q.Zh., 2003. Computer Graphs. Beijing: Metallurgical Industry Press.

[3] Dai, H., 2007. Image segmentation and information extraction of CT sequence. Journal of the University of Shanghai for Science and Technology. 29(2), 165-169.

[4] Dai, H., Yang, Y.F., 2010. Algorithm based on fast image segmentation and animation generation of Matlab talus. China Organizational Engineering Research and Clinical Rehabilitation. 26(4), 4764-4769.

[5] Zhou, Zh.H., Wu, Y.Zh., Zhao, M., 2010. Medical Image Programming technology. Beijing: Electronic Industry Press.

DOI: https://doi.org/10.26549/met.v6i2.11434

SYNERGY PUBLISHING PTE. LTD.

Modern Electronic Technology

http://www.advmodoncolres.sg/index.php/amor/index

Research and Exploration of Automatic Welding Wire Technology for Horn

Ming Chen* **Yangbao Liu** **Lufeng Wang**

Shenzhen Little Helper Intelligent Equipment Co., LTD., Shenzhen, Guangdong, 518000, China

ARTICLE INFO

Article history
Received: 10 July 2022
Revised: 10 August 2022
Accepted: 15 September 2022
Published Online: 16 October 2022

Keywords:
Fully automatic
Horn soldering
Technological change

ABSTRACT

With the development of science and technology, the electronic component industry has become more and more extensive, covering circuits, electrical and electrical systems from small to large. Many of these parts have very high requirements for the production process, and the production process requires a certain amount of workshop space. In the traditional production process, soldering is mainly manual welding. With the development of intelligence, impersonality and automation, the design of electronic products will gradually move towards intelligence. In this process, the application and promotion of welding technology is essential. In order to ensure the production of automatic products, this paper studies and discusses the function control problems and solutions of the soldering machine. Loudspeaker (commonly known as loudspeaker) is one of the most widely used electronic devices. With the development of the electronic industry and the change of the market environment, major manufacturers are developing new products to meet the market demand and product performance. In order to meet the needs of a large number of high reliability electronic products with different structures now and in the future, automatic welding technology is required to ensure that the welding quality and reliability have certain advantages.

1. Introduction

Due to the wide variety of electronic components and the increasingly high production process requirements, the traditional manual welding can no longer meet the market demand, so many electronic component manufacturers actively develop new automation products to meet the market demand and product performance requirements. In recent years, with the rapid development of automatic welding technology, this technology is expected to be widely used in the future. With the increasing demand for flexible electronic products in China, self-developed automation products, production technologies and supporting equipment have also emerged, effectively meeting the development requirements of the transformation and upgrading of the domestic electronic industry. This paper takes industry as the research object, aiming to play the role of industry in research and exploration.

2. Technical Principle

The connecting wire between the horn and the circuit board is soldered together with tin wire. In the current production, most parts are manually operated and assembled. Now all electronic component manufacturers have adopted automatic horn soldering technology to meet the needs of large-scale production process. The adoption of automatic welding production line technology can improve production efficiency and effectively adapt to the development requirements of the transformation and upgrading of the electronic industry. The automatic welding line equipment is mainly composed of wire cutting part,

**Corresponding Author:*
Ming Chen,
Shenzhen Little Helper Intelligent Equipment Co., LTD., Shenzhen, Guangdong, 518000, China;
Email: 2438396213@qq.com

 DOI: https://doi.org/10.26549/met.v6i2.11867

welding part, visual inspection part, automatic loading and unloading manipulator, etc. The welding head is the core part of the automatic spot welder, and its quality and performance directly affect the subsequent welding effect. Therefore, the welding head must be carefully designed and selected in all aspects of the welding machine. There are many types of welding heads, which can be interchanged, but their functions are the same, that is, to use their own inherent functions to achieve good welding results in the welding process. The welding wire used for welding on the spot welder is mainly tin wire. High frequency soldering iron is used as heat source for tin wire welding [1].

3. Design Analysis

This topic is developed on the basis of the existing automatic horn welding line equipment, including soldering mechanism, CCD vision system, wire cutting mechanism, automatic loading and unloading manipulator, PLC control system and fixture. The welding mechanism is composed of 2 high-frequency soldering irons and 4 precision tin breakers. The CCD vision system consists of two cameras [2]. One camera is used for precise positioning, and the other camera is used for finished product inspection. The system aims to reduce errors and errors in manual operation. The design scheme is mainly applied to automatic processing and detection of horn soldering tin.

4. Analysis of Key Technical Parameters

In the production process, the quality of welding head is very important. Therefore, the design quality of the welding head is good, which can effectively ensure that the welding materials produce uniform molten pool on the workpiece. However, in practice, this problem exists. For example, for circuit board tin, if it does not meet its requirements, tin leakage may occur [3]. Therefore, it is necessary to determine the appropriate welding head quality index from the actual project. The welding head is the core part of the automatic spot welder, and its quality and performance directly affect the subsequent welding effect. Therefore, the welding head must be carefully designed and selected in all aspects of the wire bonder. There are many types of welding heads, which can be interchanged, but their functions are the same, that is, to use their own inherent functions to achieve good welding results in the welding process [3].

The control system mainly includes: cylinder control, manipulator control, welding workpiece, power switch and instrument system. The welding process of the workpiece is realized by rotating the cylinder with the manipulator. As it is a semi-automatic production equipment, it can meet the following requirements: 1) High production efficiency: the equipment is mainly mechanical action, while the robot is mainly automatic action; 2) Simple operation: there is a big difference between manual mode and automatic production; 3) High safety performance: it is easy to generate sparks under mechanical action; 4) High welding quality: it can continuously and automatically complete complex point-to-point processing tasks to ensure safety; 5) Easy maintenance: high production efficiency and high degree of automation; 6) Good production environment; 7) High efficiency.

5. Function Design of Automatic Welding System

During manufacturing, most electronic products need to be welded to the motherboard to ensure consistency after assembly. After welding, the parts need to be put into the product for assembly. The system realizes the connection between the automatic welding equipment and the motherboard, making the entire automation system more perfect. The overall efficiency is greatly improved. The system can detect and locate by CCD vision, transmit the data to PLC and store it on the memory card, which maximizes the automation of the whole process.

5.1 Adopt Modular Design System

Adopt modular design to improve the overall efficiency. Classify the modularization degree of devices, and adopt different working methods for different device models (such as horn, PCB, buzzer, atomizer, switch, etc.). Automatic welding equipment has two working modes: full-automatic welding line and semi-automatic welding line. The working principle of full automation is to realize automatic loading and unloading, automatic thread cutting, automatic welding, automatic detection, and unmanned operation. Semi automatic welding line can realize automatic cutting and automatic welding, which requires manual loading and unloading and manual detection. The automatic welding device of the utility model enables the operator to carry out automatic welding more flexibly and conveniently through the mechanical control mode.

5.2 Fully Automated Working Process

First, the wire enters the straightening mechanism and straightens the wire. Then enter the wire cutting and peeling stage, dip one end of the cut wire with tin to avoid loose copper wire, and then weld the other end on the welding point of the horn. At the same time, the CCD

DOI: https://doi.org/10.26549/met.v6i2.11867

camera recognizes the direction of the horn to realize automatic feeding, and the CCD camera detects whether the welding is good. To ensure that the finished products are completely qualified. If any nonconformity is found, alarm and mark it as defective product,.

5.3 Test Function

In order to ensure that the size of the welded horn meets the requirements of the standard specifications, ensure the assembly accuracy, and thus ensure consistency, it is necessary to carry out spot welding assembly positioning and testing. After the test, check the data through a series of methods to verify the reliability of the connection, and then store the data on the card and upload it to the computer [4].

5.4 Safety Device

In order to prevent dangerous accidents, safety devices must be installed on automatic welding equipment to prevent damage to products and casualties. Safety facilities include access switches and safety gratings. When the equipment is running, open the door or touch the safety grating, the automatic welding system will give a fault alarm and stop the operation at the same time to ensure that no casualties occur. The safety device is equipped with overflow protection, overload protection and short circuit protection. When overflow protection is set, fire can be prevented by external circuit short circuit. Too strict protection can avoid the risk caused by too long overload time.

6. Full Automatic Welding Machine Control System Process

The working process of the automatic wire bonder control system is as follows: 1) When the welding equipment enters the preparation state, the confirmation of air pressure and voltage is required; 2) If the air pressure is insufficient or no air pressure is found, the equipment cannot operate [5]; 3) A reset is required after everything is ready. 4) Press the start operation button, the equipment will automatically carry out direction identification, automatic feeding, straightening, cutting, peeling, tin dipping, wire feeding, welding, detection, blanking and a series of automatic operation actions; 5) When the tin wire is used up or broken, the equipment will give a warning, which requires manual handling; 6) When the small tin dipping furnace is used for a certain number of times, the equipment will automatically clean the tin slag. The method adopted in the system design is to monitor the operation steps and parameters of the welding machine in real time through the intelligent terminal. Connect the servo motor with the cylinder drive circuit through the serial port, make the servo motor rotate in the corresponding direction, and realize the real-time monitoring and evaluation of the welding machine movement and parameters according to the predetermined program commands. Through the corresponding interface, you can see all the relevant data information of the product during welding.

6.1 Faster Welding

All parameters and resistance of the power supply before welding shall be within the standard range. If the requirements are not met, it is impossible to complete the specified range. In actual operation, general welders will not interrupt their own welding process according to the actual situation. In order to ensure that the current meets the stable parameter range, the current is often adjusted during the welding process. However, the common practice at home and abroad is to heat the welding machine with several sets of heating tubes to maintain the normal operation of the welding machine. From the practical operation, the wire bonder can be heated in a short time by using a high-frequency temperature controller, which will produce a better welding effect.

6.2 Prepare for Fusion

In the operation of automatic welding machine, broken tin wire is very important. It can achieve accurate and fast welding. Therefore, it is necessary to constantly adjust the pressure to make the tin breaker achieve the desired effect..

6.3 The Current Switch Closes Automatically

The inverter can control the motor speed by controlling the motor speed, and then change the welding current to reduce noise. Judge whether to execute the next operation according to the detection signal, and adjust the corresponding operation of the controller. The control part is controlled by the microprocessor and can be closed intermittently during welding. Other sensors monitor the movement of welders and welding equipment and detect the presence of joints.

6.4 Protection Function

The automatic welding machine system does not take action against some faults in the production process, but only to ensure the normal operation of faults, and also to ensure production efficiency. Therefore, in the normal production state, the automatic welding machine should be well protected in case of failure. There are two main

 DOI: https://doi.org/10.26549/met.v6i2.11867

protection modes: one is to automatically turn off the protection function in case of welding failure (that is, take measures immediately to stop the machine when a failure is found); The second is the safety protection function (that is, in the safety protection state, it can effectively avoid the damage to the operator caused by the fault) The system design mainly adopts two methods to achieve the above functions, one is to install voltage protection for the welding machine. Second, set the protection function (that is, in case of failure, the protection function will be automatically closed. When the welding signal changes, the protection function will automatically terminate).

7. Conclusions

At present, the automatic welding line equipment has been successfully applied to the production of various electronic components, providing great help for electronic component manufacturers. Nowadays, the performance of electronic products is getting higher and higher, and the requirements for automation, product quality and service quality of manufacturing enterprises are also getting higher and higher. With the improvement and innovation of wire bonder, the automation level of wire bonder will be higher and higher, and the efficiency of wire bonder will be higher and higher. Traditional manual labor not only consumes a lot of time and energy, but also has a certain impact on the production environment. The automatic welding line equipment is mainly studied to make it have high response speed, low vibration, high efficiency and other performances. The automatic feeding, welding and blanking with high efficiency and stability can improve the production efficiency, meet the labor demand in the production process, and reduce the cost and pressure of the production enterprise.

References

[1] Zhang, Sh., Du, B., Wang, Sh., 2022. Research on manufacturing process of millimeter wave loudspeaker. Modern Manufacturing Technology and Equipment. 58(02), 133-135.

[2] Kang, M., Lin, X.Y., Deng, X., et al., 2021. Research on MIG automatic welding process of horn V-shaped aluminum alloy profile ramp. Non Ferrous Metal Processing. 50(03), 19.

[3] Li, G.Ch., Zhong, Sh., Huang, W.X., et al., 2020. Research on vacuum brazing process of 3A21 aluminum alloy feeder horn. Hot Working. 49(13), 147-150.

[4] Hao, X., 2019. The design and implementation of automatic dispensing system based on machine vision. Guangdong University of Technology.

[5] Li, Y.Sh., Xie, Y.Y., An, H., 2006. Application of electron beam welding technology in pyramidal antenna. Welding Technology. (05), 24-26+1-2.

DOI: https://doi.org/10.26549/met.v6i2.11867

SYNERGY PUBLISHING PTE. LTD.

Modern Electronic Technology

http://www.advmodoncolres.sg/index.php/amor/index

A Study on 'the Market for Lemons' and the Strategy of 'Unification' in Booking Systems: A Case Study on the FAHSYSU Simulation T System of the Training Center for Clinical Skills of the First Affiliated Hospital of Sun Yat-sen University

Yiyan Dai*

The First Affiliated Hospital of Sun Yat-sen University, Guangzhou, Guangdong, China

ARTICLE INFO

Article history
Received: 10 July 2022
Revised: 10 August 2022
Accepted: 15 September 2022
Published Online: 16 October 2022

Keywords:
Information asymmetry
The market for lemons
Akalov mode
Adverse selection
Tao

ABSTRACT

Based on the blueprint of the training center for clinical skills of our hospital, this paper discusses the effect of 'the market for lemons' in its booking system from the perspective of economics of information, uses the law of large numbers and the central limit theorem to model to carry out the case study of FAHSYSU Simulation T, and takes measures of offsetting adverse selections to increase booking efficiency. The paper also analyzes how to apply the ancient Chinese theory that man is an integral part of nature to wipe out 'the market for lemons'.

Out of Tao, one is born; out of one, two; out of two, three; out of three, the created universe [1].

1. The Market for Lemons①

'The market for lemons' [2] in the narrow sense exists between the trading parties, in which 'information asymmetry' leads to different degrees of adverse selection. However, information asymmetry is everywhere, and 'The market for lemon' can be found in all interactive behaviors.

This paper discusses about the 'the market for lemon' in the booking management module of the information

① The market for lemons is also known as the market for inferior products, also known as Akerlof Mode. It refers to the market with asymmetric information. In extreme cases, the market will stop shrinking and just disappear, which is the adverse selection in the economics of information. The market for lemons stems from that one side of the transaction does not know the real value of the commodities (the seller has more information than the buyer). The average quality can only be judged by the average price in the market. Because it is difficult to distinguish the good from the bad, buys are only willing to pay the average price. Therefore, sellers who provide good commodities will naturally suffer losses, while those who provide bad ones will benefit. Then good commodities will gradually exit. As the average quality decreases, the average price will also decline, and the commodities whose real value is above the average price will gradually exit, leaving the bad commodities alone in the market [2]."

**Corresponding Author:*
Yiyan Dai,
The First Affiliated Hospital of Sun Yat-sen University, Guangzhou, Guangdong, China;
Email: 798659652@qq.com

 DOI: https://doi.org/10.26549/met.v6i2.11869

system and how to achieve effective communication between administrators and users, to run the system in a way more intelligent and more stable.

2. The Birth of the Market of Lemon in Booking System

2.1 The Origin: Out of One, Two is Born

2.1.1 Information Asymmetry Caused by the System's Manual Management

(1) Original System (Figure 1): Systematic Judgement/'One' means information symmetry. Appointment (not occupied)→Succeed.

(2) System Status: Man-machine Integration (Figure 2)/'Two' means information Asymmetry.

Applicants make appointments, and the administrators carry out approvals- 'Reservable' does not represent the final feedback.

(3) The Inevitability of 'Two Born Out of One'

Advantages: 1) Approvability; 2) Appointment priority filtering; 3) Flexibility; 4) Teaching-orientation. All these improve the management of the training center.

However, 'the market for lemons' appears.

2.1.2 The Birth of The Market for Lemons - Three Born Out of Two

(1) Prerequisite: Blind box-Information Asymmetry (Figure 3):

Blind box (approval by the training center): a. Administrators' intervention. b. Uncertain before the appointments.

(2) 'Lemons': Failed Appointments And Low Efficiency

The 'blind box' has the following effects:

1) Between appointments and approvals, the 'blind box' increases the number of appointments. The supply

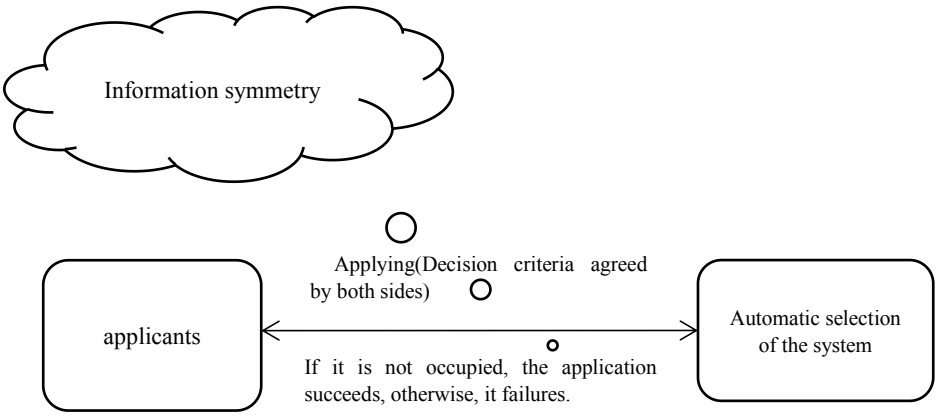


Figure 1. The original design of the system (in which administrators are not the first to make adjustments and approvals)

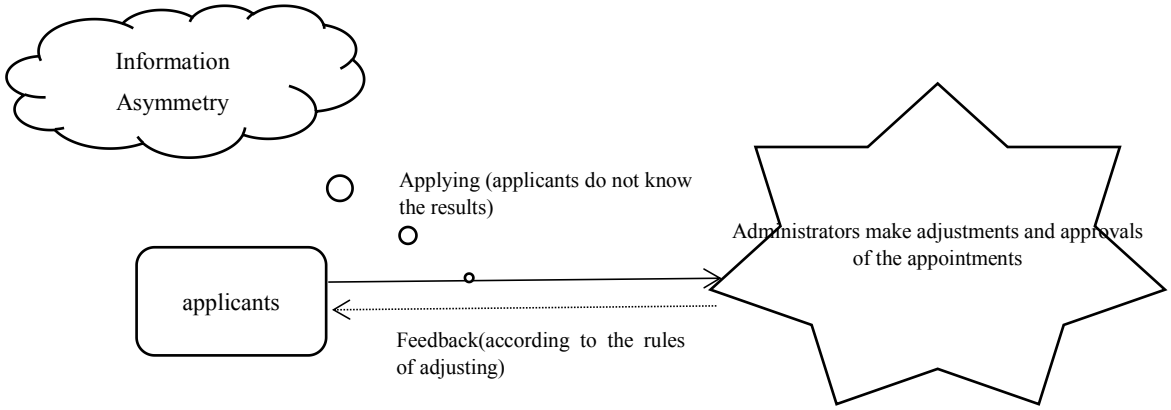


Figure 2. Current system (manual management is introduced into the system to make adjustments and approvals when there are collisons)

DOI: https://doi.org/10.26549/met.v6i2.11869

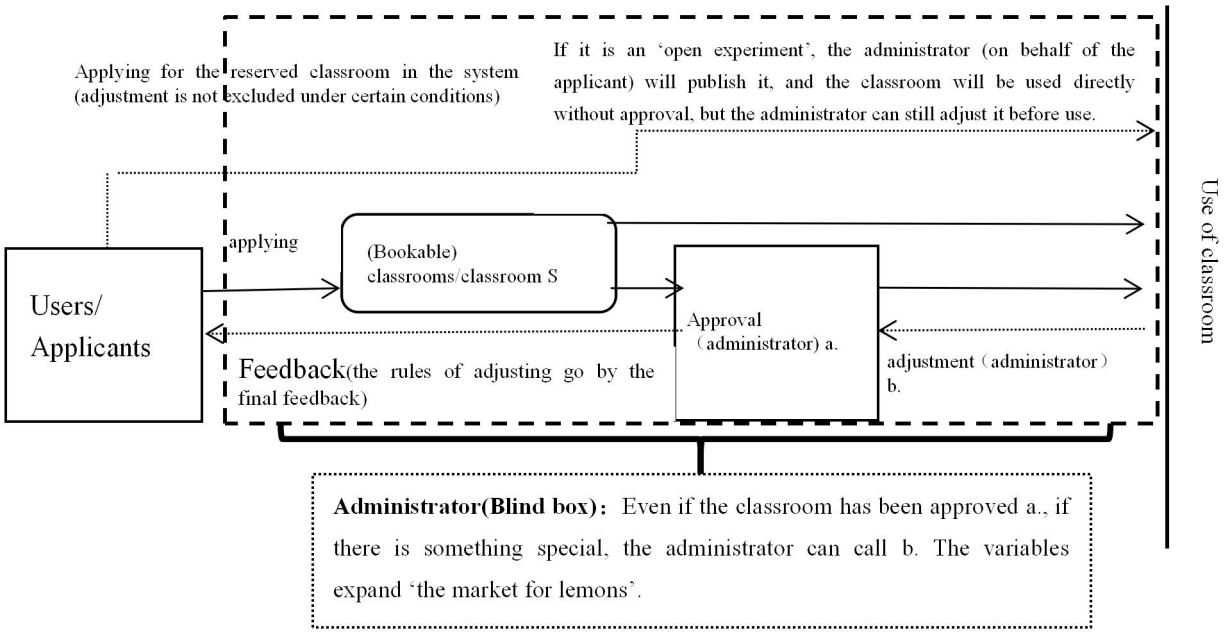


Figure 3. The range of adjustment of appointment in the booking system of the training center

is less than the demand, resulting in failed appointments. The applicants do not know about it and make appointments over and over time again, thus causing the decline in SR②.

2) The adjustments before use expand the time range of approvals. Then SR goes down and users' experience is impaired.

3) Short approval time limit can lead to the missing of urgent and important appointments or situations in 2); Long approval time limit can cause difficulties for adjustments when there are a large number of appointments, and the appointment failure rate is high, like 'deep wells without water'③, and users' experience is impaired; Flexible approval depending on actual conditions leads to an information processing not regular enough.

4) 'Blind box' makes appointments easy to be superimposed in time and space dimensions, with a wide range of approvals and reduced SR. The 'snowball' effect increases at this time and adjustments slow down, forming a vicious circle.

This paper believes that the above problems are due to the destruction of the 'Unification' mechanism, resulting in a decline in efficiency. How to ensure that the system returns to 'Unification' under the premise of completing more tasks, so that the training center can operate efficiently with the help of the booking system?

② SR: Success rate

③ Deep wells without water: a metaphor for waiting for a long time but making no appointment

2.2 The Mathematical Analysis of 'Three Born Out of Two' [3]

The following is a 'modeling' for the management and interaction in the training center's booking system, FAHSYSU Simulation T, to find the answer of 'unification'.

Modeling: 'The Akerlof Mode 1' of booking management of the training center

Event A in this model is 'successfully applying for a classroom' (Because different classrooms in the training center have different functions, there may be inherent differences in users' daily application rates. At the same time, in the process of application, the administrators will make coordinated arrangements of the classrooms, which leads to the mutual dependency of the classrooms. Therefore, this study analyzes all the classrooms as a whole to investigate the features of overall application SR). Appointment SR: p (A)=p.

2.2.1 'Idealized' Process - Original Systematic Judgment ('One')

Information symmetry: The both sides have, i. the same information, and ii. synchronous behaviors (appointment is equal to approval) (the both sides are exactly the same).

The appointment SR is 100% (p is identically 1). The distribution of 'idealized' appointment SR is shown in Figure 4.

 DOI: https://doi.org/10.26549/met.v6i2.11869

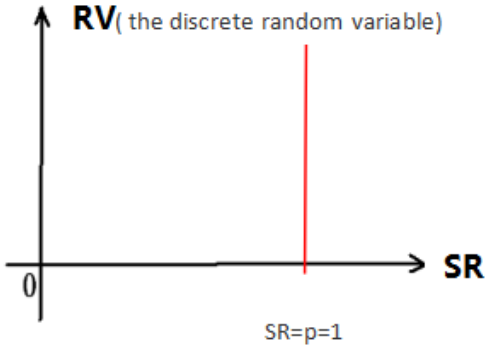


Figure 4. The distribution of 'idealized' appointment quality ('One')

2.2.2 'The Market for Lemons' Effect Caused by 'Blind Box'

(1) Prerequisite

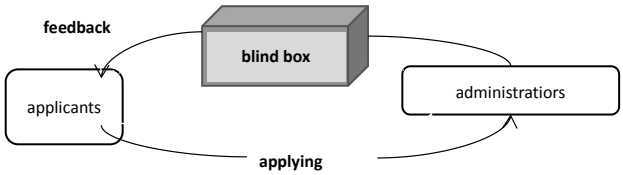


Figure 5. The current information system: information asymmetry (blind box)

(2) The Distribution of Appointment Quality under The Prerequisite

'Two is born out of one': the booking system needs approvals (blind box), and the both sides do not have, i. the same information, and ii. synchronous behaviors (the unity of knowledge and practice).

Information asymmetry results in a SR<100% (there are appointment failures, and SR≠100%), 0<p<1 (there are also appointment successes, and p≠0).

According to the law of large numbers, in a great quantity of repeated random events, there are laws almost inevitable.

The user makes an appointment at FAHSYSU Simulation T, which conforms to the characteristics of the n-fold Bernoulli experiment (independent). The random variable obeys the binomial distribution of B (n, p) (0<p<1).

'The distribution of appointment quality' of FAHSYSU Simulation T:

refers to the number of event A, or 'successful appointments' in the n-fold Bernoulli experiment, which is the quality level of the appointment, or m. refers to the probability distribution of different m (high or low success times)

The progress of 'Three Born Out of Two'

The first stage, the beginning stage: *Initial status:* t=0, the system is started for appointments, OT④, p=1, n=1, SR=100%. As shown by the yellow column ■ in Figure 6, there are many free classrooms in the training center (information symmetry) - the SR is 100%, and it is still in the state of 'unification'. But the 'unification' does not last long.

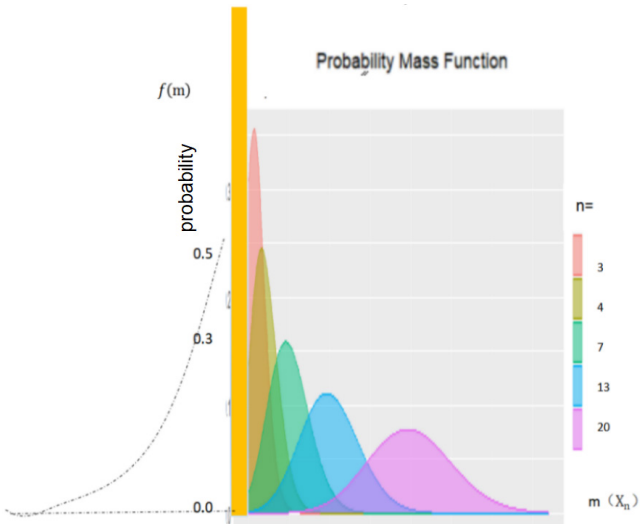


Figure 6. 'The distribution of quality' of appointments in the information system of the training center(at the beginning stage)

Dynamic process of reverse selection (Figure 6): On time, affected by the 'blind box', the supply and demand do not match and adjustments become increasingly difficult. The blind growth of n expands the information gap between administrators and applicants.

It can be seen that, over time, regardless of the average speed of information processing (approval), the 'blind box' between administrators and applicants becomes larger and the information asymmetry is exacerbated. SR starts to decline 100%↓, p↓. The distribution of appointment quality gradually becomes worse (negative skewness n=3→positive skewness n=13). Adverse selection occurs and 'the market for lemons' effect is revealed.

The second stage, the mid-term stage: On time, the value of n is stable. Compared with beginning stage, at which n rose sharply, the appointments in the system entered a normal state. ~N(np,np(1-p)), as shown in Figure 6. (n=20)

Dynamic process of reverse selection (Figure 7):

Initial status: p=0.5,

In some peak seasons of assessment, appointments are overlapped in time and space with many complicated conflicts, and the impact of approvals on appointments is enhanced. SR↓.

④ OT: on time, t: time, n: number of appointments

DOI: https://doi.org/10.26549/met.v6i2.11869

It can be seen from dynamic Figure 7 that t →+∞. Observing from any different dimension of n, m ′ ↓, m "↑. (m ′+m")/2=↓, and when n changes little, p=0.5 ↓→ 0.1

The opacity of the time-space structure of the appointments brings about the 'blackening' of the blind box. At this time, n does not reduce, and the supply and demand do not match, accelerating the decline of p. There is a serious ositive skewness (bs[5]>0 ↑), and the 'differentiation' is aggravated.

The third stage, the long-term stage: The number of long-term appointments will increase, and when n is high but p is low, Poisson distribution (λ= Np) is approximate.

Initial status: p=0.05,

The gap between demand and supply are very large, and the blind box is overloaded.

λ ↑, bk[6]↓, $f(np)=\frac{1}{\sqrt{2\pi np(1-p)}}=\frac{1}{\sqrt{2\pi\lambda(1-p)}}$, when λ is high and p is low, the kurtosis approaches 0. SR → 0, and the system goes failure.

2.3 'Out of Three, The Created Universe Is Born' and 'The Butterfly Effect'

'The distribution quality of appointments' of the FAHSYSU Simulation T system appears, that is, there are applicants and administrators in the system. The blind box set a blocking both between applicants and administrators, and between one applicant from another. So it is can be assumed as an independent Bernoulli experiment. But is that really the case?

The well-known 'butterfly effect' explains that at all times and in all countries, many big events or a big era often originate from some small inconspicuous factors at the beginning, which can be seen as the 'One'. This 'One' is very critical, because the trigger of its fission will cause the incredible results.

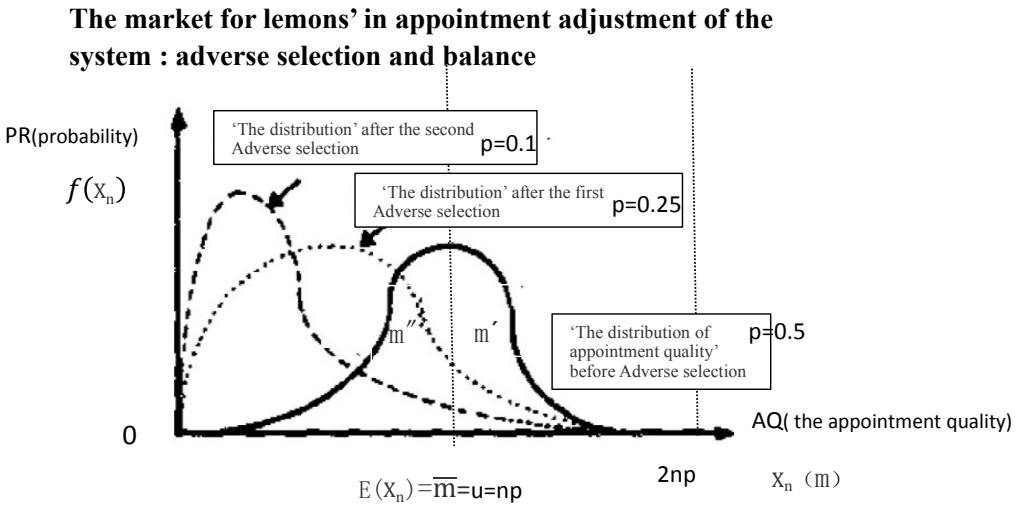


Figure 7. 'The distribution of quality' of appointments in the information system of the training center(at the mid-term stage)

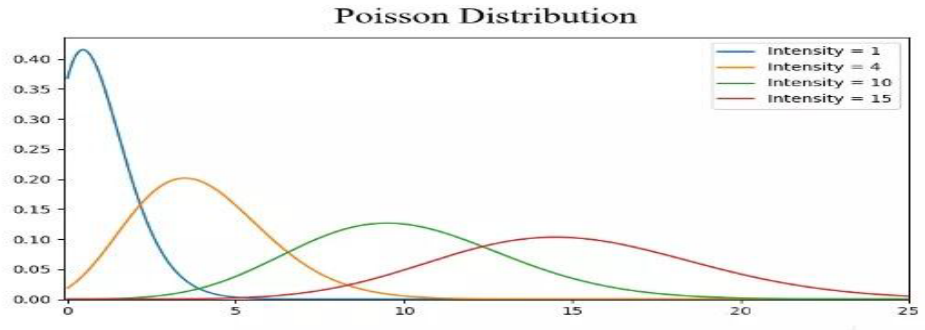


Figure 8.'The distribution of quality' of appointments in the information system of the training center(at the long-term stage)

④ bs>0: positive skewness, the peak moves left. bs<0: negative skewness: the peak moves right

⑤ Bk: kurtosis

 DOI: https://doi.org/10.26549/met.v6i2.11869

All this is hidden in the 'blind box'. Everything is interrelated. Nothing can be completely separated from another. Not independent of each other, the system of things can be regarded as an approximate assumption:

As mentioned above, the influence of the users' booking amount on the adjustment difficulty of the administrators leads to a worse distribution, which also indirectly affects the appointment success rate of other users. When the blind box is closed, the temporary adjustment difficulty remains unchanged, and the appointments are independent of each other, which is similar to the distribution analysis. However, over time, the mutual influence becomes greater, and the distribution changes constantly.

It can be seen from the above gradual process that the dispersion of the distribution is getting larger and larger. When the number and structure of the above blind box are seriously affected, the distribution goes almost a complete failure. (low success rate of matching and low efficiency).

Nevertheless, the 'butterfly effect' is like a larger blind box. As an individual 'user', it is difficult to understand the box from a micro perspective. How do you know what is going on inside? Can you tell how dark can the 'blind box' be?

So, is it urgent to find a way of 'unification'? Do you have a heart to go home?

2.4 'The Akerlof Mode 2' of the Booking Management of the Training Center

The above analysis considers neither the loss of efficiency nor alternative places. What if these factors are considered?

Due to the low SR, poor user experience, selection mechanism and other factors, the training center tries to look for some alternative classrooms to achieve high-quality appointments.

Model 2: Assumption: quantity distribution of appointment quality⑦ of different classrooms (Figure 9).

Expectation (maximum efficiency): The selection is distributed to the right of the

red vertical line 1.

The selection mechanism of FAHSYSU Simulation T: to display manual filtering according to the conflicts: suppose the red and green are chosen.

Reverse selection: 1) The yellow is lost and the blue is flowing in. 2) The green squeezes out, with a lack of item supply.

The distribution of appointment quality goes worse: 1→2→3.

Classroom 2: The appointment quality increases.

From the above analysis, it can be seen that 'the market for lemons' still exits even if the best is not achieved. Is there a lot of pressure on readers at this moment?

So what is inside the blind box?

3. The Unification Analysis of 'The Market for Lemons'

3.1 Strategy Research 1: The Greatest Truths is Concise, and Man is an Integral Part of Nature

To achieve a balanced unification in the interaction of

'The market for lemons' in appointment management II: Reverse selection of values

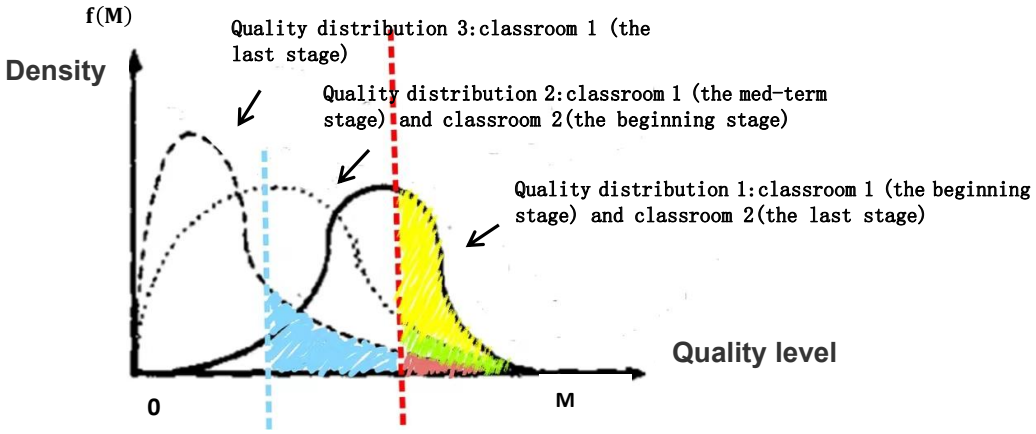


Figure 9. The adverse selection in the distribution of appointment quality

⑦ **appointment quality:** Model 1,the number of successful appointments.Model 2,the quality level of appointments

DOI: https://doi.org/10.26549/met.v6i2.11869

FAHSYSU Simulation T.

Open the 'blind box': to effectively transform unknown information of users.

3.1.1 Publicity of Sorting Optimization

Users and users, as well as users and administrators, are connected by sorting (the following Figure 10), to realize the unity of knowledge and practice, and to achieve 'unification'.

As shown in the figure below, when quantity, conflict, time and space, and dynamic adjustment are presented, they are free to advance or retreat.

3.1.2 To Find out the Law and Achieve Unification

The design of sorting rules is very important, and it is difficult to reach a high degree of consistency between the information transmitted and the decisions. Therefore, the initial model will not be particularly accurate. Later, according to the calculation results, the final value will be manually adjusted and reversely fit, the model coefficient will be adjusted, and new features will be added.

UI of the FAHSYSU Simulation T system:

No.	Real-time sorting of appointments	
	Timeline switching 7:00 . . . 17:30 . . 8:00	classrom MOOC OSCE1-15 Multi-media
1	Appointment a	||||
2	Appointment b	||||
3	Appointment c	|||||
4	Appointment d	|||||
5	Appointment E	|||||||||
6	Appointment e	| |
7	Appointment f	||||
8	Appointment g	| ||||||||
…	……	……

Figure 10. UI of the FAHSYSU Simulation T system

Appointments in the previous system were almost independent and random. Through the above measures, both sides can be connected. 'Real-time sorting of appointments' is like the 'One', indicating the matching direction. When the success rate reaches 100%, the unification is achieved. However, the decision-making direction in reality is constantly fine-tuning and the influencing factors are numerous. Therefore, 'sorting rules' do not seem to be so easy to design. So the 'One' can only be approached, and $p \neq 1$. Isn't it another kind of 'unification', a 'unification' towards the 'ultimate truth'?

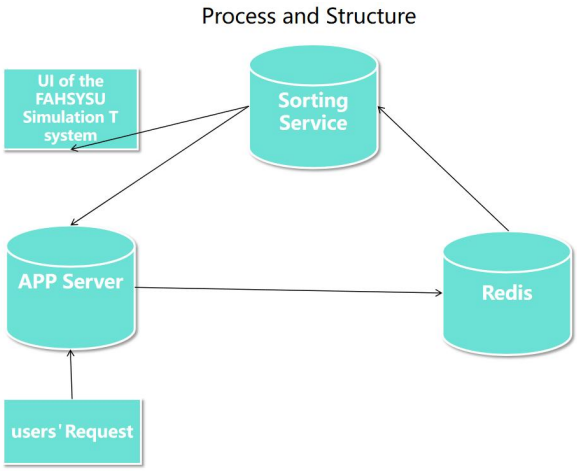


Figure 11. Upgraded system

'The market for lemons' disappears when the blind box has a high resolution ratio, easy to understand.

There is a state in life that is to be simple towards childishness, and to be complicated towards simpleness. Many philosophers have been looking for this state all their lives.

3.2 Strategy Research 2: To Overcome Firmness by Gentleness

'The Akerlof Mode 2' of the booking management of the training center: the adverse selection of value shows a pressure of 'natural selection and survival of the fittest'. However, although the author still often 'regrets', it seems that the secret of nature are showing itself gradually.

The ancient Chinese sages are free like immortals. Perhaps the 'Tao' here is not 'natural selection and survival of the fittest' (as the dinosaur era has passed). The 'sorting rules' do include other elements:

It is also a natural principle that to overcome firmness by gentleness in *Tao and Teh*. As for natural selection and survival of the fittest, everything needs to compete on its own, and face the world fairly and justly.

The change of strength lies in the trend. If we can understand the law of the trend, we can overcome firmness by gentleness! Therefore, after saying that the best of men is like water, Laotse said that 'In his dwelling, the Sage loves the lowly earth; In his heart, he loves what is profound; In his relations with other, he loves kindness; In his words, he love sincerity; In government, he loves

DOI: https://doi.org/10.26549/met.v6i2.11869

peace; In business affairs, he loves ability; In his actions, he loves choosing the right time.'

There is only the right, not the best.

'Unification': a natural law. Ancient sages said that the key to the success of the giver is 'to do without competition'. The most intelligent and successful people are not 'competing' for success. Their success is the result of cooperating with others to generate new values and make the cake bigger together. The premise of not harming others is also an attitude of giving, altruism and cooperation. It is still of profound significance to us now.

3.3 Strategy Research 3: A Community with a Shared Future for Humanity

As mentioned above, we need to make the cake bigger together. How?

According to the above analysis, the 'good' sorting rules are designed for high efficiency. What will happen when classroom 1 runs with a high efficiency?

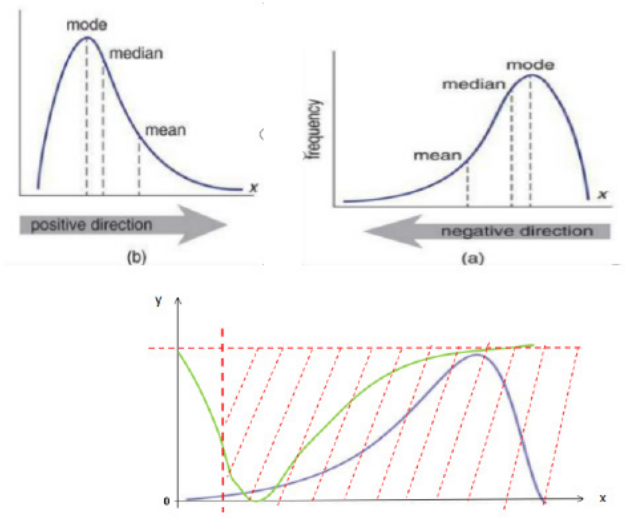


Figure 12. The combination of classroom 1 and 2(Inside the area of red lines)

The distribution of appointment quality of classroom 1 will become better. Because of the increase of efficiency and the full use of resources, the distribution of appointment quality (n↑) will be improved and also expanded horizontally (b→a:The Akerlof Mode 1 & 2). Cooperation, openness and mutual benefit, as the teachings of ancient sages, will be an inevitable development trend.

'There is only the right, not the best.' (*Tao and Teh*)

Since the 18th CPC National Congress, President Xi has expounded and advocated the concept of building 'a community with a shared future for humanity' on numerous international and domestic occasions, which shows a in-depth insight into 'Tao'. The idea of building 'a community with a shared future for humanity' is genetically homologous with the 'Tao' in Confucianism, Buddhism and Taoism of traditional Chinese culture. It reveals the natural way of 'returning to nature and integrating nature and man'.

The whole nature is under the management of 'Tao' and runs according to certain laws. The unification of man and nature means that people should respect the laws of nature.

According to the concept of returning to nature, health refers to the mutual matching and adaptation between man and nature.

The scene of 'streets full of envoys and businessmen' of the ancient Silk Road has created the exchanges of different civilizations. In the 'The Belt and Road Initiative' today, no matter how far apart and different we are, complementary advantages, joint cooperation, common development and mutual benefit can be achieved with 'a community with a shared future for humanity'. This is an experience of great value for human civilization, and also an inevitable choice for human society to move towards a future of happiness, peace, harmony and beauty.

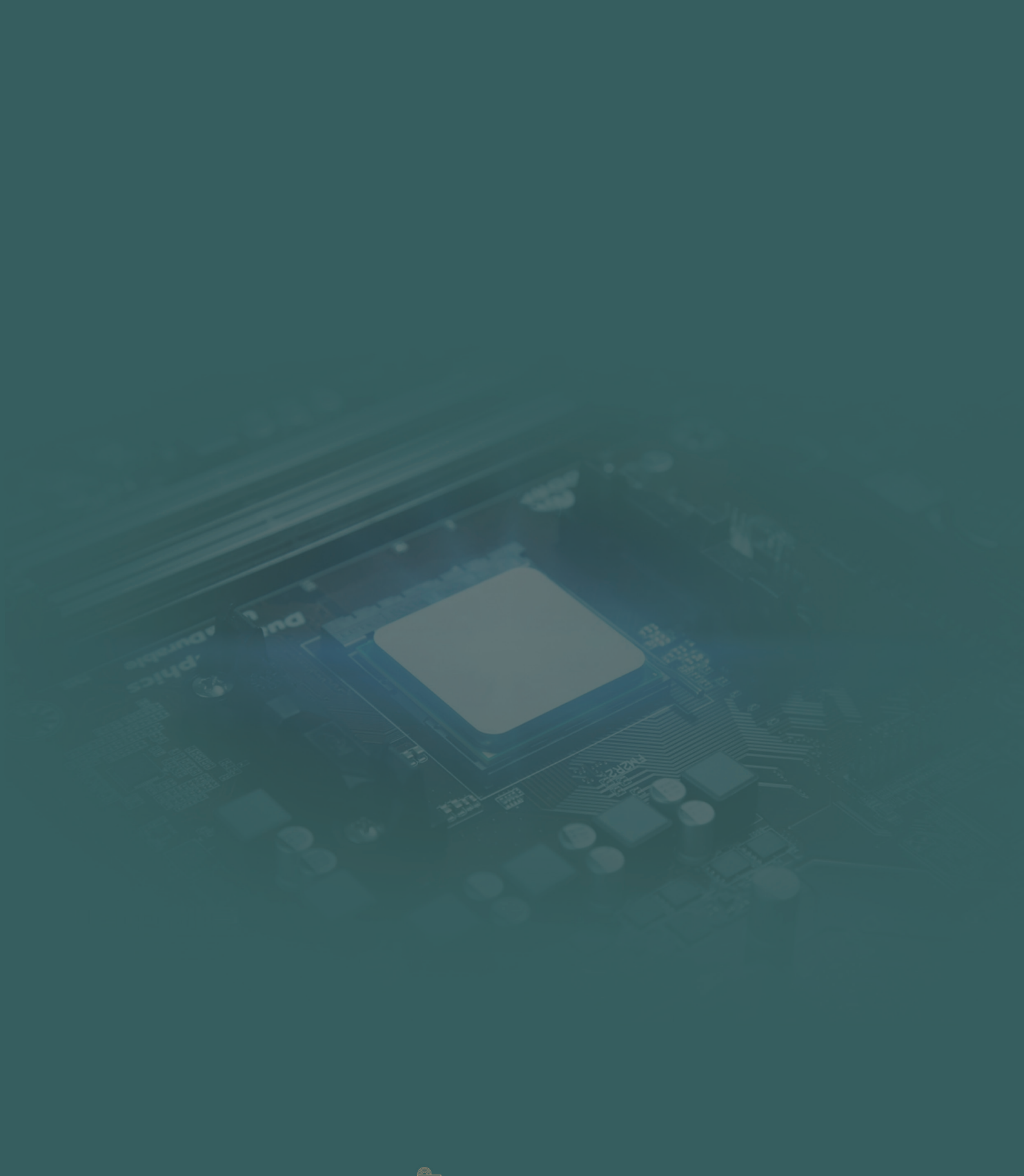
References

[1] Laotse, The Spring and Autumn period of China. Tao And Teh.

[2] Geogre, A., 1970. The Markets for 'Lemons': Quality uncertainty and The Market Mechanism. The Quarterly Journal of Economics. 84(3), 488-500.

[3] Sheng, Zh., Xie, Sh.Q., Pan, Ch.Y., 2011. Probability Theory and Mathematical Statistics. Zhejiang University, Higher Education Press.

DOI: https://doi.org/10.26549/met.v6i2.11869



SYNERGY
PUBLISHING PTE. LTD.
Tel: +65 65881289
E-mail: contact@s-p.sg
Website: ojs.s-p.sg

2591-7110
02
9 772591 711221