International Journal of Computer Information Systems and Industrial Management Applications.
ISSN 2150-7988 Volume 5 (2013) 227-234
© MIR Labs, www.mirlabs.net/ijcisim/index.html

Toward Next Generation E-Marketplace for Small Business

Youssef Iguider[1] and Hiroyoshi Morita[2]

[1] The University of Electro-Communications, Graduate School of Information Systems
1-5-1 Chofugaoka, Chofu, Tokyo 182-8585, Japan
iguider@gmail.com

[2] The University of Electro-Communications, Graduate School of Information Systems
1-5-1 Chofugaoka, Chofu, Tokyo 182-8585, Japan

***Abstract*: The objective of this work is to shift the emarketplaces' focus from search-oriented matching, toward assistance-providing business matching systems for the next generation e-marketplaces for small business. By addressing the issue of business-matching and recommending in business-to-business e-marketplaces, through the use of Collective Intelligence (CI) means. To make the most of CI's capabilities, this work considers also the need for converting the business information available on handwritten documents into electronic data toward enabling it to become searchable online.**

Keywords: *Collective Intelligence, e-marketplace, small business, handwriting recognition, information systems.*

I. Introduction

A. Collective Intelligence (CI)

This research effort is partially inspired by the vision of Dr. Douglass Engelbart [1] about the use of technology to improve our collective intelligence for the betterment of humanity, by integrating social-cultural strategies with new technology to create a new way to portray information [1]. Dr. Engelbart (who is also a colleague and mentor to one of the authors) is often considered the main founder of the field of Collective Intelligence (CI) [2][3]. CI is defined as the capacity of human collectives to engage in intellectual cooperation, in order to build new conclusions from independent contributors [4]. This study is an attempt to apply CI approach to e-marketplaces for small businesses.

B. Existing e-Marketplaces

Business consulting and business matching for small and large businesses is mostly provided offline. A service that usually comes with more costly expenses than what small business can usually afford. Moreover, the recommended business matches are often geographically limited to local or regional partners. Few online e-marketplaces provide international business matching services. Most of these platforms simply list the same static information from their databases similarly to all users. Without truly taking into account the specific needs and background of the user [5].

C. Small Business

Although the sector of small business has a big impact on nations' economies [5], small businesses are too often severely treated by the market's realities. It is a fact that only about 50% of small businesses remain in business after their first 3 years. Small businesses are exposed to bigger threats than larger companies, because they do not have the back-up of extra finance and resources that larger companies possess. Difficulties to commercialize their products; mismatched trading, and the lack of funding partners are often listed among the top challenges that are commonly faced by small businesses, which often lead to their failure [5][6].

D. Handwritten Business Documents vs. e-Marketplace

The recent advances in on-line data capturing technologies and its widespread deployment in devices like PDAs and notebook PCs, is creating large amounts of handwritten data that need to be archived and retrieved efficiently. On the other hand, because of the global digital divide created by unequal socio-economic levels, small business, especially in rural areas of developing countries, often have their business information and transactions almost entirely recorded on paper by handwriting. So it is important that next generation e-marketplaces could make use of OCR technologies and handwriting recognition solutions for converting handwritten business documents and other scanned documents into indexable and retrievable data [7][8]. The increase of such relevant information would enable better correlation, and therefore improve the matching and recommending of business partnerships. Moreover, since handwritten signature remains the most widely accepted biometric means for identity verification in business agreements [9], it makes sense to apply the proven technologies and algorithms which enable author verification and identification via handwriting analysis.

The following sections present and discuss a new business-matching and recommending system. The recommended matches are later served via a novel visual interactive graphical interface. An attempt to address the issue of converting handwritten business documents into online searchable data for e-marketplace is outlined. Further an overview of the initial experimental studies is presented.

II. Targeted Information System

Information systems (IS) are combinations of technologies and people's activities using that technology to support operations, management, and decision-making.

A. Hardware-Driven Information Systems

Early IS solutions were operating based on primitive systems that used machine codes and data, to have the central processing unit of computing devises execute specific instructions. These primitive systems often executed one program at a time, and operated mainly as specific hardware-dependent systems. We represent this era of information systems as the “Hardware Management” stage, in Figure 1.

B. Software- Driven Information Systems

Later, in the 60s through the 80s, after hardware capabilities evolved to allow similar software to run on more than one platform, advanced operating systems were born. Which enabled multi-tasking information systems to operate a large amount of software applications. Which help the users perform common tasks and activities in the real world. We represent this era of information systems as the “Software Management” stage, in Figure 1.

C. Knowledge-Driven Information Systems

The expansion of the World Wide Web and the explosion of Internet interactions, led to the constantly increasing production of a huge amount of online data, which is doubling approximately every six months [10]. Therefore, we believe that there is an emerging need for new data management systems, able to take advantage of these large amounts of data, by uncovering new, implicit and potentially useful knowledge from them. And also creating new knowledge out of their interlinked characteristics. This knowledge operating information systems would play a vital role in the information industry. We represent this era of information systems as the “Knowledge Management” stage in Figure 1.

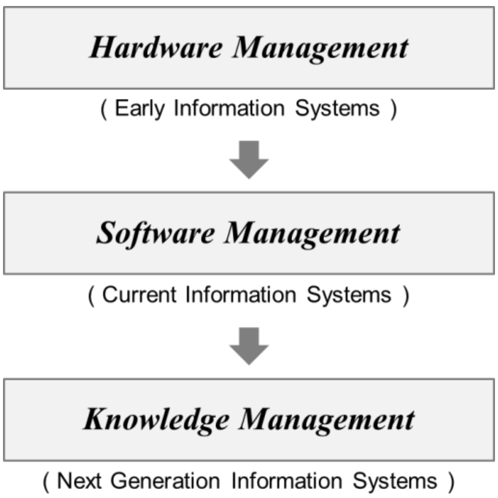


Figure 1. Evolution of information systems

D. Collective Intelligence Based Knowledge-Driven IS

This work presents a knowledge managing IS model, based on collective intelligence, which we later apply to develop a new business-matching system for next generation e-marketplaces. CI is a multidisciplinary philosophical framework, which integrates social-cultural strategies with new technology to create a way to portray information, with the goal to include, view, and aggregate as much information as possible in order to enable people to act strategically to solve complex problems [1][11].
The basic idea behind our proposed knowledge-managing system is illustrated below in Figure 2, and the process is described below:

1) Collective-Intelligence Collection: Acquiring data and information from independent users then provisioning that data in a way which ensures a later optimal processing.

2) Intelligence Processing: Converting the collected data into a form suitable for producing intelligence. By conducting various detailed analysis, comparisons and information correlation among the collected data.

3) Personalized Services: Reducing information overload, by focusing on the consumer's specific need, to interpret the processed information into a finished intelligence product that may help the user draw analytical conclusions.

4) New Knowledge Creation: Aggregating the collected data and processed information, to systematically and dynamically create new knowledge that may convert lacking information into expanded intelligence.

5) Customized Expertise Servicing: Conveying expanded intelligence in a usable form, to support user’s decision-making with personalized and relevant insights.

6) Intelligent User Interface: Creating new ways of structuring facts, and new ways of interacting with the system, is key to extending people’s capability to create, manipulate and share knowledge [1].

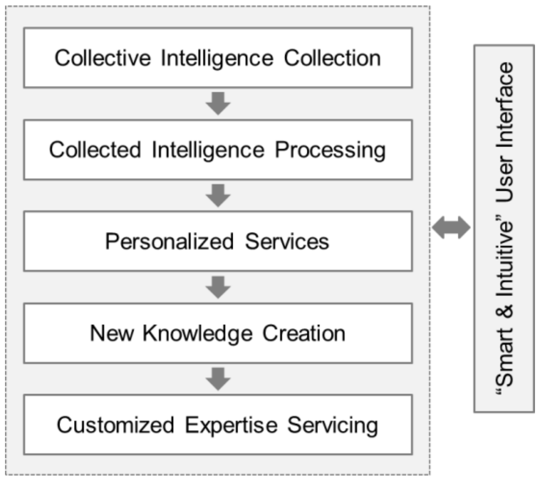


Figure 2. CI based knowledge management

III. CI Based System For E-Marketplace

This section attempts to apply the approach discussed above, toward designing a CI based new business-matching and recommending system model for e-marketplaces.

Unlike most existing e-marketplaces, where the system usually simply matches companies and lists to the user straightforward search results from available static databases [5], the proposed system model (Figure 3) uses a CI approach toward the process of business-matching and business opportunity recommending. As shown in Figure 3, at first, various data are collected from the collectively submitted users' business (selling or buying) proposals, as well as from their company's profile and background. With the goal to allow traders to have access to the untapped business opportunities which are not available electronically, but on paper. And also with the goal to help bridging the digital divide with traders in many developing countries, especially in rural areas. The system may accept also the information that is captured from handwritten document and transformed to digital data. Moreover the recent advances in on-line data capturing technologies and its widespread deployment in devices like PDAs and notebook PCs is creating large amounts of handwritten data that need to be archived and retrieved efficiently, especially that recognition algorithms and engines are already available for all major language scripts [12][13]. The collected data are then processed and carefully indexed. Then, based on the user's query, and also based on his/her recorded business background and company's profile, the system conducts various analysis and correlation operations, on the user's data vs. the data of the potential candidate partners, and their business proposals and needs. With the goal to reduce the search result overload, and instead convey to the user personalized business recommendations specific to his/her needs, interest and background [14]. The goal is also to enable the user uncover new relevant business opportunities that might not be easily reachable though straightforward search of a static database.

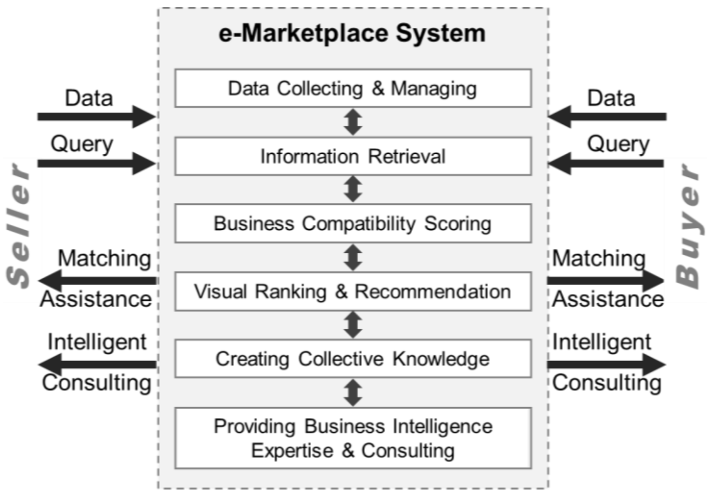


Figure 3. CI based system for e-marketplaces

Table 1. illustrates an example, where a part of the user's information is scored and matched against the data of other identified business-partner candidates. With the goal to evaluate the user's compatibility with the identified business-partner candidates, and qualify the potential of their proposed business opportunities, the user's attributes are mapped against the attributes of the identified partner-candidates, via several correlation means, including the matching via Euclidean Distance Scoring (1).

Attribute #	Attributes Description	User	Candidate Partners				
			P-1	P-2	P-3	...	P-n
A_1	Company Country	$S_0(A_1)$	$S_1(A_1)$	$S_2(A_1)$	$S_3(A_1)$	...	$S_n(A_1)$
A_2	Business Category	$S_0(A_2)$	$S_1(A_2)$	$S_2(A_2)$	$S_3(A_2)$	...	$S_n(A_2)$
A_3	Company Age	$S_0(A_3)$	$S_1(A_3)$	$S_2(A_3)$	$S_3(A_3)$	...	$S_n(A_3)$
A_4	Capital	$S_0(A_4)$	$S_1(A_4)$	$S_2(A_4)$	$S_3(A_4)$	...	$S_n(A_4)$
A_5	Business Volume	$S_0(A_5)$	$S_1(A_5)$	$S_2(A_5)$	$S_3(A_5)$	...	$S_n(A_5)$
A_6	Employees	$S_0(A_6)$	$S_1(A_6)$	$S_2(A_6)$	$S_3(A_6)$	...	$S_n(A_6)$
A_7	Offer type (Proposal)	$S_0(A_7)$	$S_1(A_7)$	$S_2(A_7)$	$S_3(A_7)$	...	$S_n(A_7)$
A_8	Product/Service category	$S_0(A_8)$	$S_1(A_8)$	$S_2(A_8)$	$S_3(A_8)$	...	$S_n(A_8)$
A_9	Minimum order ($)	$S_0(A_9)$	$S_1(A_9)$	$S_2(A_9)$	$S_3(A_9)$	...	$S_n(A_9)$
A_{10}	Targeted region/s	$S_0(A_{10})$	$S_1(A_{10})$	$S_2(A_{10})$	$S_3(A_{10})$	...	$S_n(A_{10})$
A_{11}	Non acceptable countries	$S_0(A_{11})$	$S_1(A_{11})$	$S_2(A_{11})$	$S_0(A_{11})$	...	$S_n(A_{11})$

Table 1. Compatibility scoring.

$$C_{(i,j)} = \sqrt{\sum_{k=1}^{11} (S_i(A_k) - S_j(A_k))^2} \tag{1}$$

Where

$C_{(i,j)}$ - Compatibility between two partner-candidates i and j

$S_i(A_k)$ - Score of a partner-candidate i with regard to the attribute A_k

To comply with the recommendation of Dr. Engelbart (CI's founder) about the importance of creating new ways and symbols for structuring facts, to extend the user's capability of manipulating the created knowledge [1], the matching results and personalized recommendations are later conveyed to the user via a new visual graphic interface, as illustrated by Figure 4 and Table 2.

Figure 4. Visual representations of the business-matching results

Colors, shapes and sizes are used to symbolize characteristics of the candidate partners, to help the user visually explore the recommended business opportunities via the graphical navigational interface.

Shape		"Offer Type" Attribute
Circle	●	SELLING
Triangle	▲	BUYING
Square	■	OTHERS

Color		"Country Area" Attribute
Blue	●	EUROPE
Yellow	●	ASIA
Black	●	AFRICA
Green	●	OCEANIA
Red	●	AMERICA
Pink	●	JAPAN

Size		"Company Size" Attribute
Small	●	SMALL
Medium	●	MEDIUM
Large	●	LARGE

Table 2. Graphic symbols interpretation.

Automated Business Consulting System

At a later stage, our research aims at creating a CI business-matching system that would enable e-marketplaces to provide automated consulting. The system aggregates the collected data to create new relevant knowledge, by systematically applying best practices of the business world. A personalized expertize would be generated to support users' decision-making and enhance their market insights and business intelligence. Figure 6 illustrates an example where the targeted automated system would systematically uncover strategic partnering opportunities for the user.

Figure 5. CI Based Automated Consulting

IV. Handwritten Business Information For E-Marketplace

This section presents a new approach to handwritten text analysis and recognition, as an attempt to help addressing the issue of converting business information available on handwritten documents into electronic data toward enabling it to be later searchable online. With the goal 1) to help bridging the digital divide in the e-Marketplaces, which treats many small businesses, especially in the rural areas of developing countries; 2) to allow users of the users of e-Marketplaces have access to further untapped business opportunities; and also 3) to address the issue of handwritten signature for e-marketplaces.

A. *An Active Analysis of Handwriting*

One of the traditional and common cases for understanding handwritten characters is gathering and analyzing statistics related to their variations in shapes, slants, stroke numbers, orders, directions and so forth, which we have called as *Passive Analysis* of handwriting. Another insight for understanding them may come from modeling the human handwriting generation and studying the perceptual aspects of the generated handwriting samples. Which we call here as *Active Analysis* of handwriting, in contrast to the previous one [13]. Figure 6 represents the process of human handwriting generation. In this approach we address the process of handwriting recognition as an inverted process of handwriting generation.

B. *Handwriting Process Modeling*

Figure 6 shows the basic idea, the system-theoretic representation of the handwriting process. The system has no feedback involved, and is supposed to be driven by a hypothetical input signal – *Control Pulse*, to produce the handwriting signal at its output.

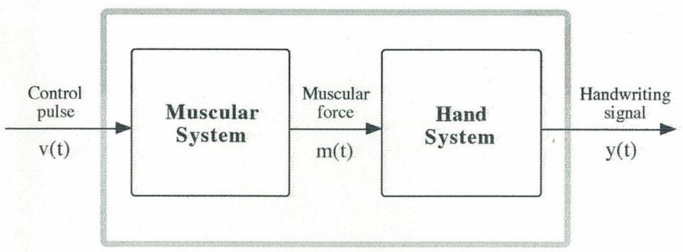


Figure 6. System-theoretic representation of the handwriting process

To model the handwriting process, handwriting system is considered to be divided into two subsystems, *muscular system M* and *hand system H*. The transfer function of the muscular system could be modeled by a moving average (MA) process, the all-zero model: $B(k, z^{-1})$. The hand system could be expressed by an auto-regressive (AR) model, having the transfer function with all-pole: $1/A(k, z^{-1})$. Thus the input-output relation of the overall handwriting system can be expressed by an Auto-Regressive Moving Average (ARMA) model having the following form:

$$y(k+1) = \frac{B(k,z^{-1})}{A(k,z^{-1})} v(k) = H(k,z^{-1}) v(k), \quad (2)$$

$$A(k,z^{-1}) = 1 + a_1(k)z^{-1} + a_2(k)z^{-2} + \ldots + a_m(k)z^{-m}, \quad (3)$$

$$B(k,z^{-1}) = b_0(k) + b_1(k)z^{-1} + b_2(k)z^{-2} + \ldots + b_n(k)z^{-n}, \quad (4)$$

$v(k)$ and $y(k+1)$ are the input control pulse and the output handwriting signal, respectively. z^{-1} denotes the operator of a unit time delay.

After estimating the parameters of both AR and MA of the ARMA model, it becomes possible to extract the control pulses of the handwriting movements by applying the MRACS theory [13].

C. *Control Pulse*

We assume that the handwriting movement may be resolved into tree principal components, namely *X*, *Y* and *Z* directions (for simplification, the *Z*-component, writing pressure, is neglected in the case of handwriting recognition). For simplification purpose, we also assume that the muscles involved in each component of the movements are grouped together into a pair to cause them generate the forces to antagonistic directions having the prescribed magnitude and timing's. Under these basic assumptions, we introduce below the definition of control pulse, which plays an essential role in our approach to handwriting analysis and recognition [13].

The control signal of the handwriting can be represented by the square waveform having three magnitude levels, which we call *Control Pulses* (Figure 7). The level *1* and level *-1* mean ON activities of the group of muscles to the positive and the negative directions, respectively, and *0* means OFF activity (later abbreviated as *ON-pos*, *ON-neg* and *OFF*). T_i's are control-timing's at which the muscular activity changes from one level to another. It is the control timing information (not the magnitude) of the force used that we need to extract from the original handwritten characters.

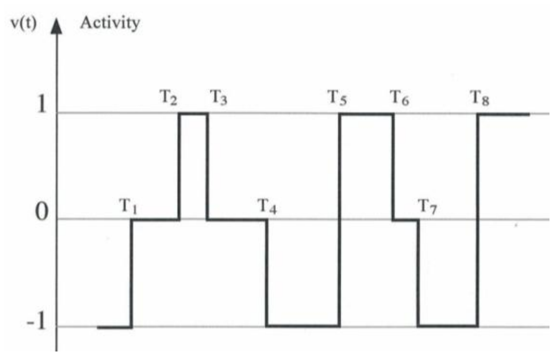


Figure 7. Control pulses sequence of the handwriting movement

We think of the control pulses to be the representation of the handwriting movement at the motor command level [13]. They are expected to be more direct representations, namely, at the higher level of handwriting process, than are the pencil-point movement. The control pulses are then expected to describe in details the behavior of the handwriting movements.

D. *An Approach to Active Recognition*

We assume here that control pulses related to the considered handwritten characters have already been extracted for both X and Y axis. Further, to simplify the notions, we use *x-pulses* and *y-pulses* to indicate the control pulses corresponding to the *X* axis, and *Y* axis, respectively. To investigate promptly the handwriting process behind handwritten characters and shapes, the system focuses on various parts of *x- pulses* and *y-pulses* (Figure 7).

The behavior of handwriting movement is therefore analyzed by estimating the *time-duration* (*TD*) related to each of the 3 muscular activities, namely *ON-pos*, *ON-neg* and *OFF*, inside the focused sequence of control pulses.

$$TD_{ON-pos} = \sum_{i=f}^{l} ON - pos \quad (5)$$

$$TD_{ON-neg} = \sum_{i=f}^{l} ON - neg \quad (6)$$

$$TD_{OFF} = \sum_{i=f}^{l} OFF \quad (7)$$

f and *l* are, respectively, the first and last control pulse of the sequence of control pulses being analyzed. By estimating TD_{ON-pos}, TD_{ON-neg} and TD_{OFF}, within parts of x-pulses and y-pulses, the system can analyze and identify the nature and orientation of the handwriting movement that led to shaping different fragments of a considered handwritten character or signature [13].

V. EXPERIMENTAL STUDIES

To experimentally study the proposed CI based business-matching and recommending system, we are currently developing a prototype that can process advanced business matching and generate recommendations, based on real-word business opportunities.

A. *JETRO's Online Business Matching Database*

To study our prototype using real-word data, experimental simulations were conducted based on data collected from JETRO (Japan External Trade Organization)'s online business matching database. JETRO is a Japanese governmental organization, which promotes mutual trade between Japan and the rest of the world. JETRO is running a free online business matching service "Trade Tie-up Promotion Program" [15]. Which allows the business people (especially small and medium companies) to browse through over 20,000 business proposals in various fields.

B. *Experimental Prototype*

The components of the experimental prototype are shown in Figure 8. At first an experimental simulation was developed using Python programing language, for parsing JETRO's proposals. BeautifulSoup classes were used to screen-scrap and parse the content of JETRO's entries. The result of this parsing led to compiling information from each entry (proposal) in JETRO database.

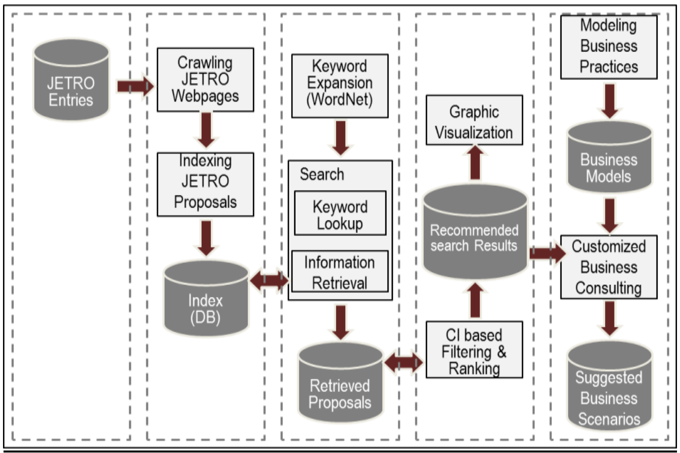
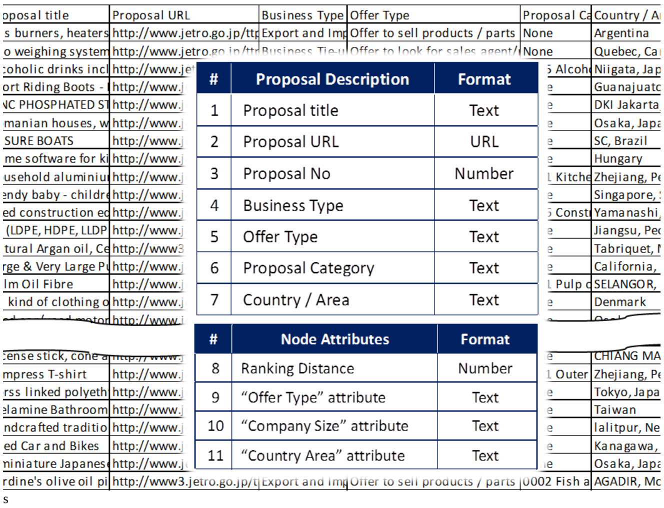


Figure 8. Experimental business-matching and recommending prototype

C. Indexing TTPP Business Proposals

To process TTPP business proposals in depth, a set of entries (Figure 9) was indexed into a SQLite database. To proceed, the contents were parsed by randomly looping through TTPP URLs to crawl their entry contents. The experimental crawler was designed to ignore a set of words which carry no important meaning. The system was also designed to identify and ignore URL of the proposals that were either expired or deleted by the users. As results, the crawled and parsed TTPP business proposals were automatically indexed into a SQLite database, which was automatically created and saved for further use.



#	Proposal Description	Format
1	Proposal title	Text
2	Proposal URL	URL
3	Proposal No	Number
4	Business Type	Text
5	Offer Type	Text
6	Proposal Category	Text
7	Country / Area	Text

#	Node Attributes	Format
8	Ranking Distance	Number
9	"Offer Type" attribute	Text
10	"Company Size" attribute	Text
11	"Country Area" attribute	Text

Figure 9. An experimental set of business proposal entries

Figure 10 shows samples of indexed data, where the database was populated with, (Figure 10.a) a list of the automatically generated and processed URLs, (Figure 10.b) parsed and processed words, and (Figure 10.c) information about how each word is associated to its related proposal, along with the position of that word in the proposal's page.

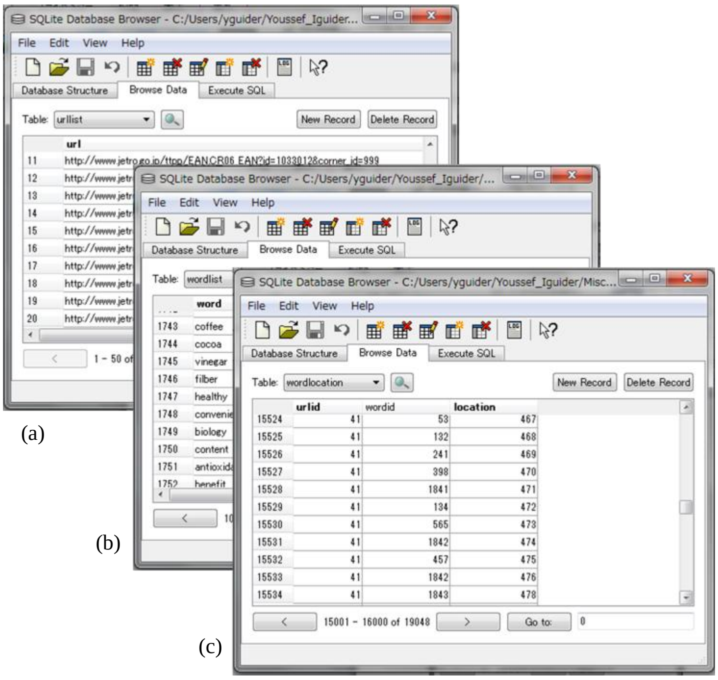


Figure 10. Sample data indexed to SQLite database: (a) URLs; (b) Indexed words; (c) Linking words to proposals.

D. Keyword Expansion Based on WordNet

To enable an intuitive-like search, the system uses WordNet to allow identifying additional words that may be relevant to the user's query. This may help uncovering hidden business opportunities that could be of interest to the user. Figure 11 illustrates an example where the system is trying to expand a submitted keyword - "carpet".

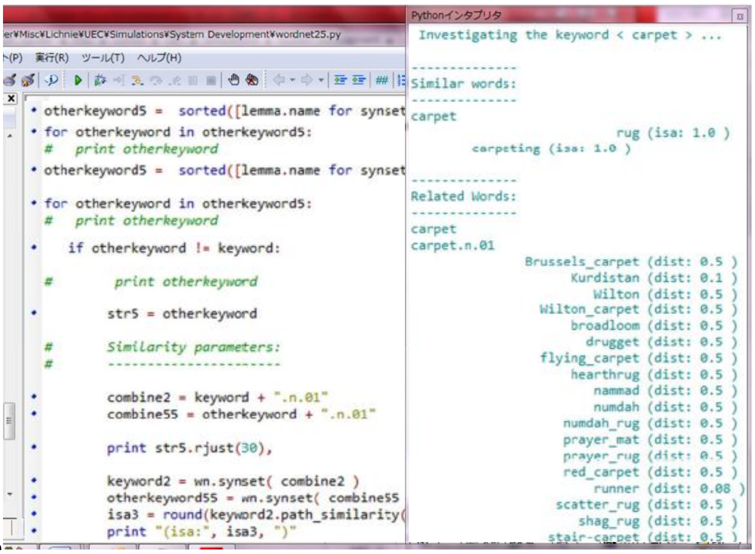


Figure 11. Simulation of expanding a keyword ("carpet")

Further, the prototype is simulated to look up the submitted keyword along with the expanded keywords in the indexed SQLite database. The content of the identified business proposals are then mapped to the attribute related to the user, by using the CI approach discussed above. Figure 12 presents an experimental visual representation of the results obtained when processing the experimental set of business proposal entries mentioned above. The results are automatically visualized via an experimental interactive graphical user interface.

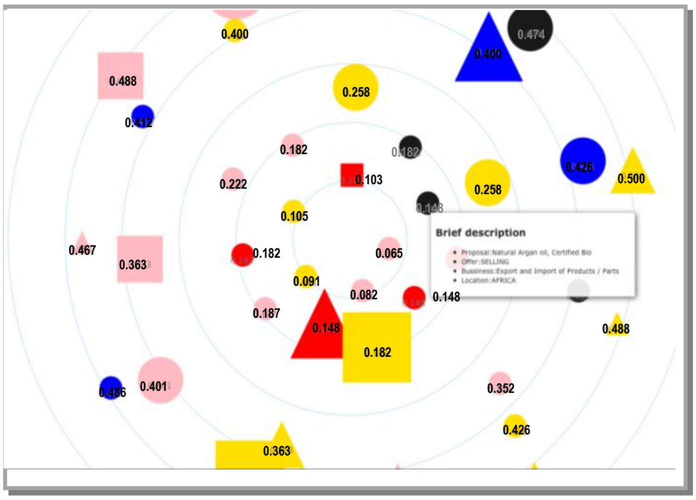


Figure 12. Experimental visual representation of business-matching results

The graph is automatically generated based on attributes related to the recommended business proposals. Each proposal is displayed in the form of an interactive node which has a specific shape, color and size. The shape, color and size of nodes are automatically assigned according to the description in Table 2. The nodes are automatically placed away from the center, based on their Distance Scoring according to (1). This enables an intuitive visual navigation of the search results. The nodes are designed to have interactive capabilities with the goal to allow visually exploring and interacting with the recommended business opportunities. For instance, by mouseovering a node, a brief description of its business proposal is displayed, as shown in Figure 13.

Clicking a node, leads to automatically placing in the center of the graph. Meanwhile information about the clicked node is transmitted (as feedback data) back to the system for further processing and compatibility scoring. Several other interactive features are currently being developed to be added to the capabilities of this interactive graphical user interface.

With the goal to have the interactive graphical user interface allow accessing the details of business proposals at any step, our experimental prototype is designed to provide a direct access back to the original business proposals as published on JETRO's TTPP website.

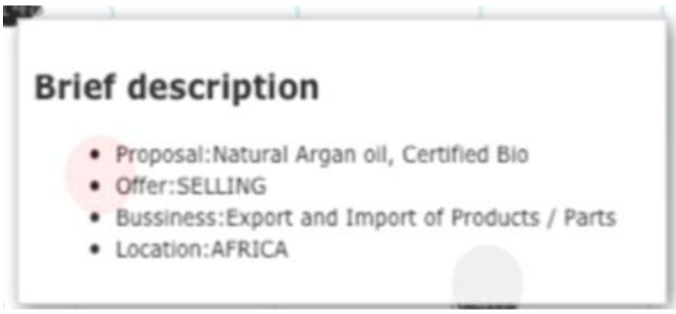


Figure 13. Mouseovering an interactive "selling" node.

We currently are finalizing the development of the prototype and its visualization system, with the goal to allow us convey the business-matching results and recommendations, via a visual graphic interactive interface, similar to what was described in Figure 5 and Table 2.

E. Handwritten Character Recognition Experiment

Arabic script using countries are home to many small businesses, where most of the business related information and transactions are almost entirely recorded on paper by handwriting. And enabling the key data from this handwritten business information to be converted into electronic data, through Arabic handwriting recognition means, would not only help these small businesses bridge the digital divide in the e-Marketplaces, but would also provide access to other global traders have access to still untapped business opportunities. We therefore used Arabic characters to experiment with the handwriting analysis and recognition approach which was described in Section IV.

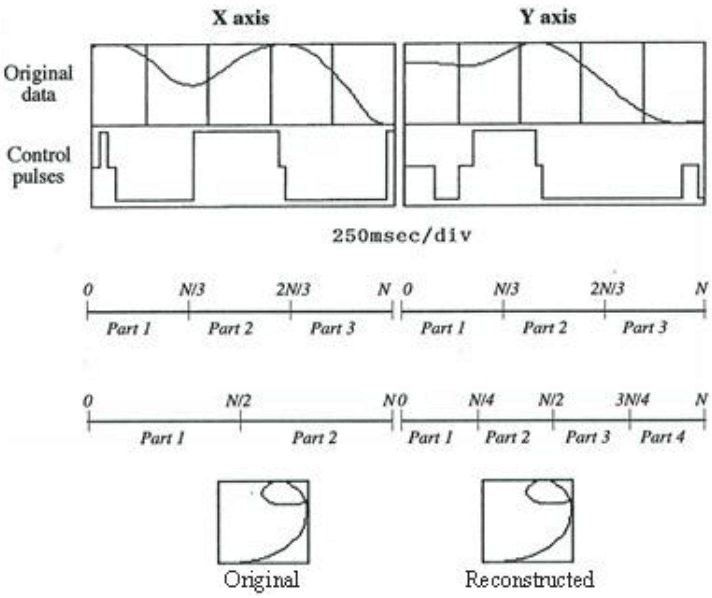


Figure 14. Investigating control pulses of a handwritten sample.

Based on the handwriting analysis approach presented in Chapter 6, Arabic character recognition algorithms were developed after investigating a large number of training samples of handwritten Arabic characters. Both the sequences of *x-pulses* and *y-pulses* for each training sample, as well as other features were studied extensively. Computer experiments were performed for all Arabic characters shown. 2400 different samples were used to carry out these experiments. Results of the recognition experiment (Table 3.) showed an average recognition rate of 98.6%.

To demonstrate the high sensitivity of the system to even tiny handwriting movements, Figure 15 demonstrates a case where it is rather difficult to recognize this handwritten sample (Arabic character "*Sin*"), just by its original *x* and *y* data. The 3 vertical maxima characterizing this character can hardly be noticed by the original data of *Y axis*. Meanwhile the same 3 maxima can be easily noticed through the control pulses by *Y axis*.

Handwritten Arabic characters presented for recognition (80 samplses each)	Recognized as:																														Correctly recognized (%)
	Alif	Ba	Ta	Tha	Jim	Ha	Kha	Dal	Dhal	Ra	Zayn	Sin	Shin	Sad	Dad	Tta	Dha	Ayn	Ghayn	Fa	Qaf	Kaf	Lam	Mim	Nun	Hha	Waw	Ya	Hamza	Ta-Marbuta	Rejected	
Alif	78																						1								1	97.5
Ba		79																											1			98.75
Ta			78																		2											97.5
Tha				80																												100
Jim					80																											100
Ha						79								1																		98.75
Kha							78								1				1													97.5
Dal								79													1											98.75
Dhal							2		78																							97.5
Ra								1		79																						98.75
Zayn											80																					100
Sin												80																				100
Shin													80																			100
Sad														78												1					1	97.5
Dad							1								79																	98.75
Tta																79															1	98.75
Dha																	80															100
Ayn																		78						1							1	97.5
Ghayn																			80													100
Fa																				79					1							98.75
Qaf							1														79											98.75
Kaf																						80										100
Lam										2													78									97.5
Mim								1																77					2			96.25
Nun					1																				78						1	97.5
Hha							1																			78					1	97.5
Waw																		1									78				1	97.5
Ya																												80				100
Hamza										1																			79			98.75
Ta-Marbuta																														79	1	98.75

Total recognition rate = 98.6 %

Table 3. Experimental recognition results

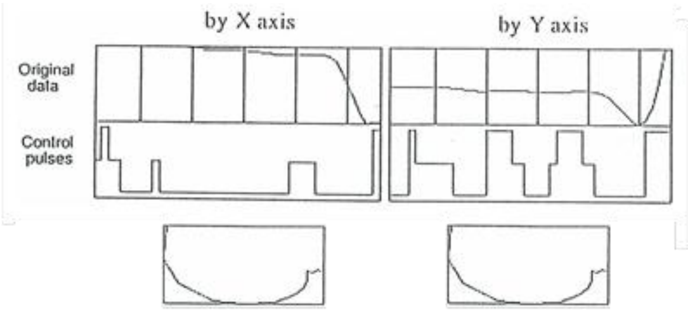


Figure 15. High sensitivity to even tiny handwriting movements.

We expect that such high sensitivity to even very tiny handwriting movements, may allow this system to be used for handling handwritten signatures on future e-marketplaces. Note that although the presented approach was experimented on analyzing and recognizing Arabic characters, it can however be applied equally well to analyze and recognize any other handwritten scripts.

VI. CONCLUSION

In this work we addressed the issue of business-matching and recommending in business-to-business e-marketplaces for small business, by making use of Collective Intelligence (CI) techniques. We also considered the need for converting the business information available on handwritten documents into electronic data toward enabling it to become searchable online in e-marketplaces. A system prototype applying the proposed and described approach is being developed and experimentally tested, to fully demonstrate the capabilities of the proposed system on real-world data. An overview of the initial experimental studies is presented. We expect the proposed business-matching and recommending system to take the business matching process for e-marketplaces into a new level.

References

[1] D. Engelbart , “Boosting Collective IQ,” *The Doug Engelbart Institute (www.dougengelbart.org/about/collective-iq.html)*

[2] P. Lévy, “From Social Computing to Reflexive Collective intelligence,” *IEML Program,* CRC, FRSC, Univ. of Ottawa, Aug.09.

[3] Stanford University’s archive “Doug Engelbart 1968 Demo,” *(sloan.stanford.edu/mousesite/1968Demo.html)*

[4] T. Segaran, “Programming Collective Intelligence,” O’REILLY ISBN:978-0-596-52932-1, 2007.

[5] Y. Iguider and H. Morita, “Moving From Search Toward Assistance in the Next Generation E-Marketplaces for Small Business,” *Proceedings of the 2011 International Conference of Soft Computing and Pattern Recognition (SoCPaR),* pp. 194-200, ISBN 978-1-4577-1194-7, c_2011 IEEE, Oct. 2011.

[6] B.S. Cromie, “Entrepreneurial Networks,” *International Small Business Journal* 9, 57-74, 1991.

[7] N.E.Makhfi, O.E. Bannay, R. Benslimane, N. Rais, “Search engine of ancient Arabic manuscripts based on metadata and XML annotations”, *Proceedings of the 2011 Colloquium in Information Science and Technology (CIST),* May 2011.

[8] G. Xian Tan, C. Viard-Gaudin, A.C. Kot, “Information Retrieval Model for Online Handwritten Script Identification,” *Proceedings of the 10th International Conference on Document Analysis and Recognition (ICDAR2009)*, Barcelona, Spain, pp. 336-340, July 2009.

[9] M.M. Fahmy, “Online handwritten signature verification system based on DWT features extraction and neural network classification,” *Ain Shams Engineering Journal*, Vol.1, Issue 1, Sep. 2010, pp.59-70.

[10] Federal Communications Commission (FCC 98-225), “MEMORANDUM OPINION AND ORDER,” Sep. 14, 1998.

[11] MIT Center for Collective Intelligence *(http://cci.mit.edu/)*

[12] S. Jaeger, C.-L. Liu and M. Nakagawa, “The state of the art in Japanese online handwriting recognition compared to techniques in western handwriting recognition,” *Internat-l Journal on Document Analysis and Recognition* - IJDAR , vol.6, no.2, pp.75-88, 2003.

[13] Y. Iguider and M. Yasuhara, “An Active Recognition of Handwritten Isolated Arabic Characters,” *Transaction of the Society of Instrument and Control Engineers*. Vol.32, No.8, pp1267/1276, 1996.

[14] A. Patel and A. Balakrishnan, “Generic framework for recommendation system using collective Intelligence,” *Proceedings of the 4th International Conference for Internet Technology and Secured Transactions* (ICITST 2009), Nov. 2009.

[15] Trade Tie-up Promotion Program. *The Japan External Trade Organization* (JETRO) (www.jetro.go.jp/ttppe/)