A Study of Interdisciplinary Development Strategies in Northeast Asia

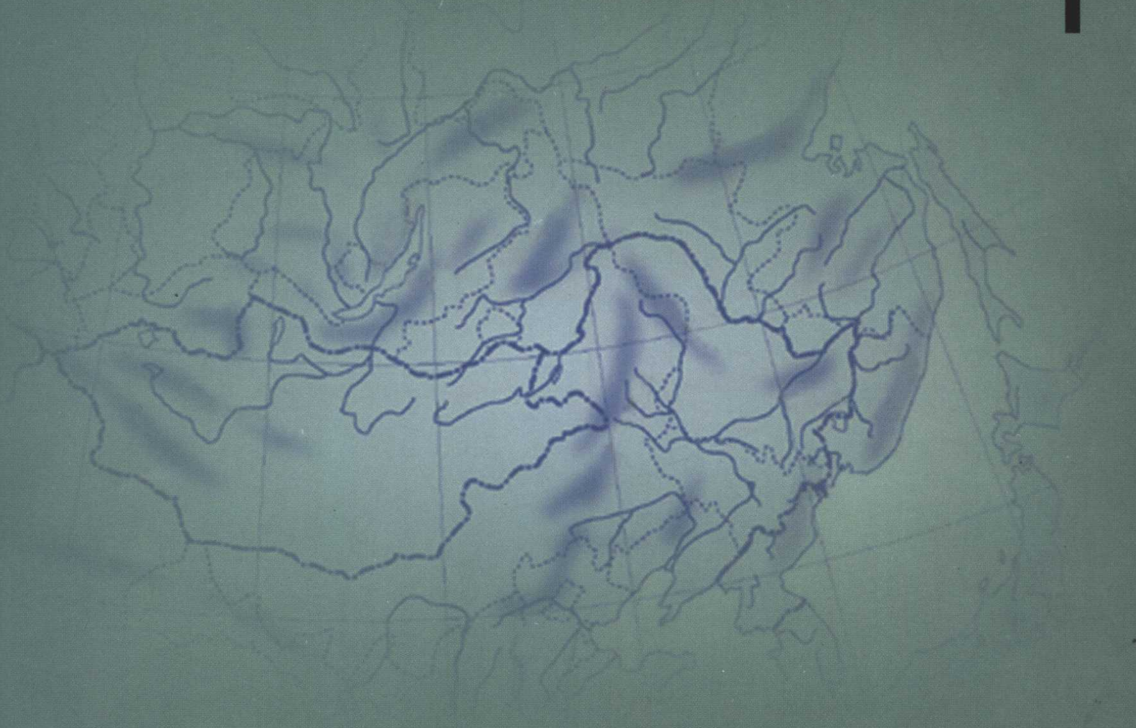
东北亚合作时代:

跨学科发展战略研究

Edited by

Institute of Northeast Asian Studies, Yanbian University

延边大学东北亚研究院 编



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Preface

I feel much privileged to have this seminal collection of articles successfully published at the Institute of Northeast Asian Studies in Yanbian University. I am of the conviction that this publication will mark a phenomenal era for both Gyeongju University and Yanbian University since this inaugural issue of collaborative studies has been pursued with the common prosperity among the countries in Northeast Asia in mind.

As is well-known, in the 21st century which is commonly called the Information Age, nations in Northeast Asia are in a position to form a regional collaborative network to cope with the challenges of global competition.

At this historical turning point, it is believed that this joint collaborative publication between the two universities as part of sharing common development strategies in such fields as economics, sociology, linguistics, civil and environmental engineering, and electronic engineering will make a tremendous contribution to the development of both countries not only in the academic respects, but also in the pursuit of common socioeconomic interests.

Hereafter, I will briefly touch upon each article published in this volume as part of general introduction.

First of all, there are 4 papers committed to the fields of economics and sociology: 'A Comparative Study on Neural Networks for Manufacturing Cell Formation' (Dr. Jun-han Lee), 'Foreign Production Externality' (Dr. Hong-mo Sung), 'Image Of Female Appearances in Korea-Japan Modern Magazine Advertising' (Dr. Dae-hwan Kim), 'The Task of National Ethics in the Information Age' (Dr. Dae-gue Kim). Dr. Lee's paper proposes a state-of-the-art approach to the manufacturing of products by applying systematic neural network. Next, Dr. Sung's article deals with import/export procedures in the age of globalized international market. Then Dr. Dae-hwan Kim's paper on female appearances emphasizes an eastern alternative to the field of commercial advertisement. Finally, Dr. Dae-gue Kim's paper on ethical issues arising in the globalized web generations provides implications for policy-making and educational practices in this region.

Second, two papers committed to the development of language and language teaching are 'Language, Linguistic Skepticism, and Tao' (Dr.Young-seok Choi) and

'Autonomy and Authenticity in the EIL Classroom' (Dr. Sang-ho Han). Dr. Choi's article is a philosophical and theoretical investigation into language and Tao, which is considered one of the cornerstones of Northeast Asian mode of living while Dr. Han's elaboration on the role of language teachers in the EIL classroom touches on the more practical aspect of language use and language teaching in the globalized international society.

Third, there are 4 papers listed in the fields of cultural history and tourism studies. First, the two articles in the field of cultural history are 'An Examination of Mortuary Practices in the Korean Bronze Age: Dolmens and Stone Cists' (Dr. Bong-won Kang), and '有关雁鸭池造景文化的研究' (Dr. Ja-young Choi). These studies shed light on new perspectives on an understanding of ancient burial practices, and landscaping in the royal palaces. The two papers dealing with more contemporary issues of tourism and sports tourism are 'A Comparative Study of the Elderly Leisure Behaviors at the Urban Parks' (Dr. Jae-joonYang) and 'An Approach to Promoting Sports Tourism For Development Of Northeast Asia' (Dr. Gook-rae Cho). Dr. Yang's paper comparing leisure behaviors of Korean and Japanese elderly citizens has much implication for planning, constructing and maintaining urban parks in other Northeast Asian countries, while Dr. Cho's paper on promotion of sports tourism suggests directions for regional cooperation and collaboration as part of civilian diplomacy among the nations in the region.

Fourth, there are 4 papers dedicated to the issue of sustainable environmental development in the modern era and that of human physiological well-being. 'A Study on the Evaluation Criteria for Reconstruction of Deteriorated Multi-Family Housing' (Dr. Moo-hyun Choi) suggests an environment-friendly approach to housing construction while the three papers in the fields of environmental engineering and Oriental medicine, 'Visibility Measurement in Korea' (Dr. Kyung-won Kim), 'The Effect of Ion Pairing and Complex Agents for Cadmium(II) Reduction under Benzyl Alcohol Film Formation' (Dr. Kyung-ho Lee), and 'The Comparative Study on Cell Viability of Mast Cell Line RBL-2H3 by Xanthii Fructus and Processed Xanthii Fructus (Dr. Jin-han Park) provide momentum for a joint research as part of establishing criterion of comparison in environmental and physiologicial issues shared among neighboring countries.

Fifth, there are 7 papers committed to the study in the fields of computer, information and electronic engineering: Real-Time Implementation of G.729 Coder for Toll-Tandem Condition (Dr. Jae-won Kim), An Implementation of a Holographic

Optical Memory System Using a Novel Angular Multiplexing and Input Methods (by Dr. Cheol-su Kim), Channel Holding Time Distributions of Soft Handoff in CDMA Mobile Communication Systems (Dr. Moo-ho Cho), Adaptive Contour Simplification Based on Morphological Segmentation (Dr. Gi-seok Kim), CAM-Based VLSI Architecture for LZ Data Compression Algorithm (Dr. Gab-joong Jeong), A Three Dimensional Musculoskeletal Model for Biomechanical Analysis of the Knee During Maximum Isometric Knee Flexion (Dr. Seon-pil Kim), The Dynamic Elements Matching Method in the Multi-bit Delta-Sigma Modulators (Dr. Deok-hwan Hyun). These papers provide not only innovative ideas for enhancing techniques in the IT industries but also introduce theories and technologies which will be adopted for ordinary public use in each neighboring country and after all facilitate regional cooperation in the IT field.

Finally, there are four papers contributed from Yanbian University: “Development of Industrial Complex in Northeast China and Promotion of Opening-Up Policy” (Prof. Kang-il Kim, Northeast Asian Institute of International Policy), “Economic and Commercial Cooperation between Northeast China and North Korea” (Prof. Keum Sook Lim, Department of Economic Management), “Changing Environment of Cooperative Development and Short-Term Development Plans in the Tumen River Area” (Prof. Piao Chengxian, Director of Northeast Asia Research Institute), and “Baseline Facilities and Developmental Aspects of Transportation Transit System in the Tumen River Area” (Prof. Jong-lim Lee, Institute of Tumen River Regional Development).

Professor Kim argues that Northeast China has been lagging behind in development compared to Southeast China due to the lack of the free market system, corporate reshuffling, and opening-up policy. He argues that keeping the opening-up commercial transaction will lead to the development of industrial complex in the area. Then, Professor Lim discusses the status quo of frontier trade between Northeast China and North Korea and suggests an alternative mutual investment plan by a thorough investigation of Chinese investment into North Korean enterprises. After that, Professor Piao argues for establishing a three-pronged approach to the developing joint economic bloc between China, North Korea and Russia in the Tumen River area. And at last, but not least important, Professor Lee argues that the transportation system in the Tumen River area depends on the relieving of tension on the Korean Peninsula and rebirth of North Korean economy. He also argues that industrial development in the region will induce more interest on the part of Northeast China in increasing corporate investment leading to the promotion of logistic infrastructure.

At last, I'd like to extend my heart-felt gratitude for contributors to this special edition of innovative articles. I sincerely hope the papers by the professors of Gyeongju University and Yanbian university will promote cooperation and collaboration not only between the two universities but also among all other universities within Northeast Asian countries.

Thank you!

February 25th, 2006

Prof. Piao Chengxian
Director of Northeast Asia
Research Institute
Yanbian University

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Part Ⅰ

Economics and sociology

A Comparative Study on Neural Networks for Manufacturing Cell Formation

Jun-Han Lee *

I. Introduction

The cellular manufacturing system(CMS) is an industrial application of a group technology concept. It has been realized that for medium part variety and low production volume, the CMS can perform efficiently in terms of some design and operational measures such as material-handling costs, work-in-process inventories, throughput times, production planning and scheduling activities(Olorunniwo 1997, Wemmerlov and Johnson 1997, Shankar and Vrat 1998). The first step in the design of CMSs is to classify similar parts into part families(PFs) and machines into manufacturing cells(MCs). This problem is addressed as the cell formation problem(CFP) in the literature.

(1) The problem of grouping parts and machines into independent cells was identified by Burbidge(1963) as 'group analysis' within the context of production flow analysis(PFA). Since then it has been addressed through several different methodologies by various researchers. Cell formation procedures can be classified broadly under two categories: 1) those that identify part families via a part design-oriented approach, involving classification and coding systems, and, 2) those that are based on a direct analysis of the production processes, particularly the routings.

(2) The methods based on direct analysis of production processes have employed a wide range of approaches, including several algorithmic and non-algorithmic procedures. Non-algorithmic procedures have included production flow analysis(PFA) and component flow analysis. Both methods are comprehensive and include several subjective and non-quantifiable inputs into the decision process. Other non-algorithmic procedures, such as the one developed by De Beer and De Witte(1978), also involve visual examination of matrices consisting of routing sheet information. They include the part-machine grouping problem, involving a

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reorganization of the rows and columns in the incidence matrix to obtain a block diagonal form. This leads to a concurrent identification of part families and machine cells. If a perfect block diagonal form is not feasible, which is most often the case, the objective normally involves minimizing inter-cell transfers for processing the parts. The intractability of this subproblem has led to the development of several heuristic procedures.

(3) The use of cluster analysis techniques was initiated by McAuley (1972) who proposed the use of single linkage cluster analysis, based on Jaccard similarity coefficient. Similarity coefficients have been widely used since then, by Waghodekar and Sahu(1984), Mosier and Taube(1985), Seifoddini and Wolfe(1986), Mosier(1989) and several others. Kusiak and Chow(1987) provide a review of these procedures and point out that, for large-scale problems, clustering methods are non-polynomially(NP) complete. Mosier (1989) analyzes the performance of several clustering methods and similarity coefficients through controlled experimentation.

(4) Other algorithms developed include the rank order clustering (ROC and ROC2) methods of King(1980) and Nakornchai (1982). ROC makes use of a decimal equivalent of the binary number arising from rows/columns consisting of zeroes and ones. The rows of the machine-component incidence matrix are sorted in descending order of this decimal equivalent, followed by a similar rearrangement of the columns. The two stages are repeated until there is no change in the matrix. The computational complexity of this procedure is of the order $O(mn^2 + m^2n)$, where m is the number of machines and n the number of parts. Chandrasekharan and Rajagopalan(1986a, b, 1987) have refined these methods, in addition to developing an efficient, non-hierarchical clustering method referred to as ZODIAC.

(5) Graph theory was first applied to this problem by Rajagopalan and Batra(1975), and to mathematical programming, by Purchek (1985). Shtub(1989) and Srinivasan, Narendran and Mahadevan (1990) have developed assignment models that are shown to be computationally superior to several prior, mathematical programming-based methods.

(6) Pattern recognition approaches based on neural networks are beginning to be applied for group technology. The use of neural networks for the classification and coding activity was discussed in Kaparthi and Suresh(1991). Different versions of neural networks applied to the cell formation problems(CFPs) are Adaptive Resonance Theory(ART) (Kaparthi and Suresh 1992, Chen and Cheng 1995, Dagli and Huggahalli 1995), the Self-Organizing Map(SOM) (Onwubolu 1999), the

Back-Propagation Neural Network(BPNN) (Chung and Kusiak 1994), the Hopfield Neural Network(HNN) (Zolfaghari and Liang 1995), and the Ortho-Synapse Hopfield Neural Network(OSHN) (Zolfaghari and Liang 1997, Liang and Zolfaghari 1999). However, these methods are criticized for several limitations. Although ART techniques (ART1, ART2 and Fuzzy ART) can solve large size problems efficiently, Dagli and Huggahalli(1995) realized that these techniques suffer from the following drawbacks:

(7) Classification depends largely on the order in which vectors are presented to the network.

(8) ART leads to very large MCs if bottleneck machines or exceptional parts are presented first.

(9) ART is sensitive to the similarity threshold level.

(10) The objective of this paper is to compare the performance of two neural networks algorithm, ART1 and Generalized Learning Vector Quantization (GLVQ), in solving both binary and comprehensive grouping problems based on previous work.

II. Carpenter-Grossberg Neural Network vs. Generalized Learning Vector Quantization (GLVQ)

Artificial neural networks(ANN) are biologically inspired; that is, they are composed of processing elements that perform in a manner analogous to the elementary functions of the biological neuron(Wasserman, 1989). The neurons process many inputs and provide a single output. The architecture of a neural network is determined by the interconnection structure among the neurons. The structure of the network gives it many unique capabilities similar to the processing capabilities of the brain. For example, it learns from experience, generalizes from previous examples to new ones, and extracts the essential characteristics from inputs that include irrelevant data.

Artificial neural networks modify their behavior in response to their environment. Such a phenomenon has been referred to as *learning*. The process of modifying a neural network's behavior has been referred to as *training*. Learning by a neural network is termed *supervised learning*, if the correct or desired category of an input pattern is also fed to the network during the training process. The network learns by examining the magnitude of the error between the desired output and the actual output. Such a training process is used for purpose of pattern recognition. In contrast, in *unsupervised learning*, the neural network is merely used as a clusterer for the identification of groups of similar patterns, without providing correct categories *a priori*. The network merely scans the input vectors and, using *exemplars* or representative vectors for every class identified, categorizes the input vectors on the basis of similarities.

Lippmann(1987) provides a taxonomy and summary of the capabilities of six different neural network classifiers. The Carpenter-Grossberg neural network(CGNN) belongs to a class of networks that accepts binary-valued inputs. This network was developed by Carpenter and Grossberg(1988) during the development of adaptive resonance theory(ART). Of the two algorithms developed(ART1 and ART2), we are concerned with ART1, which uses discrete, binary-valued inputs.

The Carpenter-Grossberg neural network is based on unsupervised learning. The various classes are not known *a priori,* and the network is operated as a *leader algorithm*. As a series of input vectors are applied, the network clusters the input vectors into distinct classes depending on the similarities. A representative vector, known as the *exemplar* (leader), is created and maintained for each class. If a new input is found to be similar to an existing exemplar, the input vector is classified under the class of that exemplar. The matching exemplar vector is also updated in the light of the new input. If a new input is not similar to any of the existing exemplars, it becomes a new exemplar. Thus, as all inputs are fed to the network, several exemplars are created, each one representing one cluster of vectors.

<Carpenter-Grossberg neural network algorithm>

Step 1. Initialize top-down and bottom-up connection weights and select ρ*:*

Top-down connection weights: $t_{ij}(0)=1$;

Bottom-up connection weights: $b_{ij}(0)=1/(1+N)$;

for input nodes i=0 to N-1 and output nodes j=0 to M-1

Select a value for vigilance threshold between zero and one: $0 \leq \rho \leq 1$.

Step 2. Apply new input vector X, consisting of zero/one elements x_i.

Step 3. Compute matching scores:

The output, μ_j, of every output node j equals

$$\mu_j = \sum_i b_{ij}(t) x_i \text{ for } j=0,\ldots,M-1.$$

Step 4. Select best matching exemplar, i.e., node(Θ) with maximum output:

$$\mu_{\Theta} = \max_{j} \{\mu_j\}.$$

The outputs of other neurons are suppressed (lateral inhibition); in case of a tie choose the neuron with lower j.

Step 5. Vigilance test (i.e., test of similarity with best matching exemplar):

Compute $\| X \| = \sum_i x_i$ = number of '1's in input vector;

Compute $\| T \cdot X \| = \sum_i t_{i\Theta} x_i$ = number of perfectly matching '1's between input vector and best matching exemplar;

If similarity $\| T \cdot X \| / \| X \| > \rho$, go to step 7; else go to step 6.

Step 6. Disable best matching exemplar temporarily:

The output of the best matching node selected in Step 4 is temporarily set to zero; other outputs have already been suppressed due to lateral inhibition; Then go to Step 3. In Step 3, a new neuron in the output layer gets selected to represent the new class.

Step 7. Update best matching exemplar:

$$t_{i\Theta}(t+1) = t_{i\Theta}(t) x_i,$$

$$b_{i\Theta}(t+1) = t_{i\Theta}(t) x_i \; / \; (0.5 + \sum_i t_{i\Theta}(t) x_i).$$

Step 8. Repeat: Go to Step 2, after enabling any nodes disabled in Step 6.

The steps involved in the algorithm, as summarized by Lippmann(1987), Pao(9189), and Kaparthi and Suresh(1992) are shown above. As the inputs are presented to this network, the first input vector becomes the exemplar for the first cluster(class j=0). The first neuron in the output layer is made to identify this class. The connection weights associated with this node(neuron) represent the elements of this weight vector(exemplar). When the next input is presented, it is compared with the first cluster exemplar. If this input is similar to the exemplar, within the limits of a specified *vigilance threshold*(ρ), it is treated as part of the first cluster; the exemplar for the first cluster is also updated in the light of the new input vector. If the new input is not similar to the exemplar, it becomes the exemplar for a new cluster, associated with the second neuron in the output layer. This process is repeated for all inputs, and the number of clusters grows with time.