The 11th International Workshop on Meta-Synthesis and Complex Systems
In the memoriam of Qian Xuesen's 100th birth anniversary

Jointly held with
The 2011 International Conference on Brain Informatics 2011

Lanzhou, China
September 7-9, 2011

Program and Abstracts

Organized by
Institute of Systems Science, Academy of Mathematics and Systems Science
Chinese Academy of Sciences, P.R.China
Series International Workshops on Meta-synthesis and Complex Systems

MCS’2001, Beijing, September 21-23, 2001
MCS’2002, Shanghai, August 7-8, 2002
MCS’2003, Guangzhou, November 29- December 1, 2003
MCS’2004, Beijing, July 21-23, 2004
MCS’2005, Kobe, November 15-16, 2005
MCS’2006, Beijing, September 22-24, 2006
MCS’2009, Chengdu, June 21-22, 2009
MCS’2010, Toronto, August 31, 2010
MCS’2011, Lanzhou, September 7-9, 2011
Welcome to MCS’2011

Activated with regular exchanges on complex system modeling mainly between Chinese and Japanese scholars as well as a major project on meta-synthesis system research (1999-2003) in China, the international workshop on meta-synthesis and complex systems became an annual event since 2001. After successful MCS2001 (Beijing), MCS2002 (Shanghai, together with KSS2002), MCS2003 (Guangzhou, together with KSS2003), MCS2004 (Beijing), MCS2005 (Kobe, one workshop of IFSR2005), MCS2006 (Beijing, together with KSS2006), MCS2007 (Beijing, one workshop of ICCS2007), MCS2008 (Singapore, a special track at IEEE SMC2008), MCS2009 (Chengdu, a workshop at MCDM2009), and MCS2010 (Toronto, a workshop at WI-IAT2010), MCS workshop will be continuously held in 2011 to provide opportunities for those researchers who are interested in systems sciences, complex problem solving and advanced modeling, knowledge-oriented technology and integration, decision sciences and support technologies, etc. to facilitate interdisciplinary studies under the context of the 2011 International Conference on Brain Informatics (BI2011) held in Lanzhou, China.

More about META-SYNTHESIS

Originally proposed in 1990 by the famous Chinese system scientist Qian Xuesen (1911-2009) towards open complex giant systems, meta-synthesis system approach (MSA) emphasizes to make full use of cutting-edge information technologies and aims to achieve knowledge creation and wisdom emergence along the human-machine collaborative complex problem solving process.

Intensive research has been engaged into meta-synthesis approach to complex system modeling with an interdisciplinary view together with more practice in both reality and the designed scenarios. In recent years, computational approaches have been greatly enhanced to explore knowledge-related technologies to detect more hidden patterns and tacit meanings from humans, which thus brings
out many new foci on diverse topics. As new wicked problems, e.g. emergency management and terrorism, bring more troubles to the current world, similar systems approaches like meta-synthesis have been of further exploration, such as the advanced concept group in Sandia National Laboratories. It is expected that MSA will be of more solid foundations and wide applications. MCS workshops aim to facilitate idea generation, knowledge sharing and scientific collaboration among those endeavors.

In the memoriam of his 100th anniversary of Professor Qian's birth, MCS2011 is dedicated to Professor Qian Xuesen, who proposed the advanced systemic thinking on qualitative-to-quantitative meta-synthesis system approach toward complex systems ahead of the times.

Xijin Tang and Xiaoji Zhou

*September, 2011*
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MCS’2011 INFORMATION

Organized by
Institute of Systems Science, Academy of Mathematics and Systems Sciences, Chinese Academy of Sciences, P. R. China

Co-organized by
Beijing Institute of Information and Control
Shanghai Academy of Systems Science
Systems Engineering Society of China
IEEE SMC Beijing Chapter
Web Intelligence Consortium
Lanzhou University

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Hosted by
Lanzhou University, China

Web site
http://meta-synthesis.iss.ac.cn/mcs2011/
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INVITED KEYNOTE SPEECH

纪念钱学森 MCS 2011 特邀大会报告

Yifu Science Hall, Lanzhou University, September 8, 2011, 8:30-9:20 am

Study of System Intuition by Noetic Science Founded by QIAN Xuesen “运用思维科学探究系统直觉”

Zhongtuo Wang 王众托院士
Dalian University of Technology, China
Chinese Academy of Engineering

Abstract:

This talk investigates the meaning, contents and characteristics of systems institution on the basis of Noetic Science, which was founded by Qian Xuesen. The systems intuition is the human capability to find the hidden system imagery of the object or to create an imagery of new system. The basic noetic foundation of system intuition and cultural influence to it are studied. The open problems are also listed.

Keywords: System intuition, noetic science, imagery thinking, inspiration, tacit knowledge
MCS’2011 SCHEDULE

Meeting Room: Yifu Science Hall 201, Lanzhou University
Chair: Xijin Tang (AMSS-CAS, China)

Session I  September 7, 2011

15:20-15:50  Xijin Tang  Opening speech
In the memoriam of Qian Xuesen’s 100th birth anniversary
Meta-synthesis and Noetic Science

15:50-16:15  Yongli Li  Evaluation and Recommendation Methods Based on
Graph Model

16:15-16:40  Mingzheng Wang  An Improved EDP Algorithm to Privacy Protection
in Data Mining

16:40-17:05  Zhen Zhang  A Hybrid Multiple Attributes Two-sided Matching
Decision Making Method with Incomplete Weight Information

17:05-17:30  Hao Lan Zhang  Utilizing Knowledge Based Mechanisms in Automa-
ted Feature Recognition Processes

17:30  Photographing of all MCS 2011 participants

Session II  September 8, 2011

14:00-14:25  Zhenpeng Li  Group Polarization and Non-positive Social Influ-
ence: A Revised Voter Model Study

14:25-14:50  Xi Xia   On-demand Dynamic Recommendation Mechanism
in Support of Enhancing Idea Creativity for Group Argumentation

14:50-15:15  Jiangnan Qiu  The Order Measure Model of Knowledge Structure

15:15-15:40  Cuiping Wei  A New Linguistic Aggregation Operator and its
Application
MCS’2011 SESSION I

1. Meta-synthesis and Noetic Science
   Xijin Tang (Academy of Mathematics and Systems Science, Chinese Academy of Sciences, China)

2. Evaluation and Recommendation Methods Based on Graph Model
   Yongli Li, Jizhou Sun, Kunsheng Wang, Aihua Zheng
   (Beijing Institute of Information and Control, China)

3. An Improved EDP Algorithm to Privacy Protection in Data Mining
   Mingzheng Wang, Na Ge
   (Dalian University of Technology, China)

4. A Hybrid Multiple Attributes Two-sided Matching Decision Making Method with Incomplete Weight Information
   Zhen Zhang, Chonghui Guo
   (Dalian University of Technology, China)

5. Utilizing Knowledge Based Mechanisms in Automated Feature Recognition Processes
   Haolan Zhang (NIT, Zhejiang University, China)
   Christian Van der Velden (BAE Systems, Australia)
1. Opening Speech: Meta-synthesis and Noetic Science

Xijin Tang

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Abstract:

Meta-synthesis system approach was proposed to tackle with open complex giant systems problems which cannot be effectively solved by traditional reductionism methods by a Chinese system scientist Qian, Xuesen (Tsien HsueShen) and his colleagues in 1990 along system re-thinking trend. The method emphasizes the synthesis of collected information and knowledge of various kinds of experts, and combining quantitative methods with qualitative knowledge. In 1992, Qian proposed Hall of Workshop for Meta-Synthetic Engineering (HWMSE) as a platform for MSA practice. HWMSE is regarded beyond the concepts of traditional decision support systems, as Qian emphasized to apply those breaking advances in information technologies into relevant activities taken in HWMSE for knowledge and wisdom emergence. Continuous endeavors have been taken to put those ideas into practice. Along the continuous study in MSA & HWMSE, doubts and critical opinions always exist.

In this talk, we review original ideas from Professor Qian about “Noetic Science”, based on his letters mainly written in 1980s and 1990s and openly published after 2008 and show how his original ideas are relevant to current achievements in qualitative meta-synthesis research.

_Keywords:_ meta-synthesis system approach, noetic science, qualitative meta-synthesis, CorMap, iView_
2. Evaluation and Recommendation Methods Based on Graph Model

Yongli Li*, Jizhou Sun, Kunsheng Wang, Alihua Zheng

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Abstract:

Evaluation and recommendation are different actions, but they are consistent in mining and using information efficiently and effectively to improve their persuasiveness and accuracy. From the view of information processing, the paper builds a two-dimensional graph model which expresses the relationships between evaluators and objects. This graph model reflects the original information of evaluation or recommendation systems and has its equivalent matrix form. Next, the principle of matrix projection can be applied to get the evaluation or recommendation vector by solving the matrix maximization problems. What’s more, a rating data set of online motive is selected to verify the model and method. In conclusion, from the example analysis, it is found that the proposed evaluation method is reasonable, and from the numerical experimental comparison, the proposed recommendation method is proved to be time-saving and more accurate than the generally adopted recommendation methods.

Keywords: data mining, evaluation, recommendation system, Graph Model
3. An Improved EDP Algorithm to Privacy Protection in Data Mining

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Abstract:

In this paper, we propose an improved pruning algorithm with memory, which we call improved EDP pruning algorithm. This method provides the better trade-off between data quality and privacy protection against classification attacks. The proposed algorithm reduces the time complexity degree significantly, especially in the case of the complete binary tree of which worst-case time complexity is of order $O(M \log M)$, where $M$ is the number of internal nodes of the complete tree. The experiments also show that the proposed algorithm is feasible and more efficient especially in the case of large and more complex tree structure with more internal nodes, etc. From a practical point of view, the improved EDP pruning algorithm is more applicable and easy to implement.

Keywords: decision tree pruning, privacy protection, complexity
4. A Hybrid Multiple Attributes Two-sided Matching Decision Making Method with Incomplete Weight Information

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Abstract:

For multiple attributes two-sided decision making problems with different evaluation attributes of both matching objects, this paper takes into account different formats of evaluation information of the matching objects and proposes a method for dealing with such two-sided matching decision making problems with incomplete weight information. Based on the ideal solution principle, the proposed method calculates the weight of attributes by solving quadratic programming models, and gets the best matching for the matching objects by solving a binary integer programming problem. The example shows the feasibility and effectiveness of the proposed method.

Keywords: decision analysis, two-sided matching, optimization model, incomplete weight information
5. Utilizing Knowledge Based Mechanisms in Automated Feature Recognition Processes

Haolan Zhang, Christian Van derVelden

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Abstract:

Modern engineering design, analysis and manufacturing activities rely heavily on software to handle increasing volumes of data and model complexity. Automated Feature Recognition (AFR) technologies are highly demanded by manufacturing sectors since AFR can efficiently improve the performance of Computer-Aided Design (CAD) processes and reduce costs. Nevertheless, most existing FR applications are confronting various problems of processing CAD models in the manufacturing industry, such as aerospace and automobile industries. The missing link between CAD models and knowledge-based tools is one of the major obstacles, which hinder the development of AFR applications in the industrial sector. This research project investigates the feasibility and benefits of bridging the gap between knowledge based mechanisms and CAD models, and suggests a knowledge-based AFR approach for tackling AFR problems occurring in the computer-aid manufacturing design process.

Keywords: Knowledge-based Systems, feature recognition, Enterprise Information System, CAD.
MCS’2011 SESSION II

1. Group Polarization and Non-positive Social Influence: A Revised Voter Model Study
   Zhenpeng Li, Xijin Tang
   (Academy of Mathematics & Systems Science, CAS, China)

2. On-demand Dynamic Recommendation Mechanism in Support of Enhancing Idea Creativity for Group Argumentation
   Xi Xia, Xiaoji Zhou (China Aerospace Engineering Consultation Center, China)

3. The Order Measure Model of Knowledge Structure
   Jiangnan Qiu, Chunling Wang, Xuan Qin
   (Dalian University of Technology, China)

4. A New Linguistic Aggregation Operator and its Application
   Cuiping Wei, Xia Liang, Lili Han
   (Qufu Normal University, China)
1. Group Polarization and Non-positive Social Influences: A Revised Voter Model Study

Zhenpeng Li, Xijin Tang

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**Abstract:**

In this paper, we analyze the relationship between the non-positive social influences towards group polarization based on the classic Voter Model. Through model simulation, we observe that a group would self-organize into two polarization pattern, under the condition of without imposing intervention, which is entirely different from the result of drift to an extreme polarization dominant state in the classic Voter Model.

**Keywords:** group polarization, non-positive social influences, social identity, Voter Model, opinions dynamics
2. On-demand Dynamic Recommendation Mechanism in Support of Enhancing Idea Creativity for Group Argumentation

Xi Xia, Xiaoji Zhou
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Abstract:

Versatile computerized aids for group argumentation for idea generation during problem solving process is becoming highlight research. In this paper, we propose a novel recommendation mechanism in the context of group argumentation, called On-demand Dynamic Recommendation Mechanism, which extracts user preferences from implicit and explicit feedbacks and provides personalized recommendation based on users' utterances and demands. The valuable reference provided by the mechanism could be accumulated to form a knowledge immersion environment to satisfy ever changing demand of users in support of facilitating idea creativity during the process of group discussion.

Keywords: meta-synthesis, group argumentation, on-demand recommendation, dynamic recommendation, knowledge creation
3. The Order Measure Model of Knowledge Structure

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Abstract:

The recent researches on Knowledge Structure mainly focused on the connotative, components and evolution process of it, but little is known about its order. For the sake of knowing the process of growth and the degree of order of Knowledge Structure, this paper has introduced the Structure entropy to calculate the degrees of extension and richness of it which are used to build the order measure model in the view of the order. As the basis of studying the process of growth, the order measure model enables the evolution rules and influencing factors of Knowledge Structure.

Keywords: Knowledge Structure, order, entropy, Order Measure Model
4. A New Linguistic Aggregation Operator and its Application

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Abstract:

In this paper, we define a new function, the generalized linguistic weighted OWA (GLWOWA) operator, to aggregate linguistic information. The proposed operator combines the advantages of the linguistic weighted arithmetic averaging (LWAA) operator and the extended OWA (EOWA) operator, and improves the linguistic weighted OWA (LWOWA) operator. We study some of its properties and compare it with the linguistic hybrid arithmetic averaging (LHAA) operator. Based on the LWAA operator and the GLWOWA operator, we develop an approach to multi-attribute group decision making with linguistic information.

Keywords: multi-attribute group decision making, linguistic information aggregation, GLWOWA operator
CONFERENCE MINING

This part shows the conference mining results which are also posted at the MCS2011 on-line conferencing ba (OLCB). The url is http://meta-synthesis.iss.ac.cn/mcs2011/analysis/index.jsp.

The mining data is composed of 10 presentations. One is the invited plenary talk given by Professor Zhongtuo Wang, one is opening speech given by Professor Xi-jin Tang, the 8 left are accepted papers from 18 submissions (the acceptance rate of MCS2011 is around 45%). The whole dataset includes 21 authors and 40 keywords.

1. iView analysis of MCS2011

1) Keyword network

This ideamap as shown in Fig.1 is constructed by linking keywords (vertexes) shared by authors -- a knowledge vision from participants of MCS2011. Which are principal topics or ideas of MCS2011? How those authors together explain their understanding about meta-synthesis and complex system research? Can you get some hints from this figure?

Fig 1. Keyword map of MCS2011 presentations

The cutpoint (the square vertex in Fig.1) is “meta-synthesis”, “noetic science”, “recommendation system”. Figure 2 shows the clustering results of the keyword network. 8 clusters are detected; the label of each cluster is also acquired based on betweenness (the right column at the table) and degree (2nd column, and 3rd column considering the weights of the link between the vertexes).
2) Human network

Figure 3 shows the human network, which is constructed by linking those authors (vertexes) who share keywords. Interesting group may be detected from human net.

2. CorMap analysis of MCS2011 presentations

Figure 4 shows the CorMap between authors and their ideas (keywords) by CorMap analysis which is a qualitative meta-synthesis computing technology to carry out qualitative data modeling, visualization and interactive analyzing.

More analytical tasks can be undertaken. For example, k-means clustering can be done, and one keyword can be selected as a label of each cluster. For example, we select k=6 and find 6 labels, “data mining”, “decision tree pruning”, “decision analysis”, “knowledge-based systems”, “multi-attribute group decision making” and “knowledge structure”.

Fig 2. The keyword network clusters and their label keywords
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Fig 3. Author network of MCS2011 presentations (cutpoint: square vertex)

Fig 4. The correspondence analysis result of the keywords and authors

The keywords of each cluster are as below.

“data mining”: voter model, tacit knowledge, system intuition, social identity, recommendation system, qualitative meta-synthesis, opinions dynamics, on-demand recommendation, non-positive social influences, noetic science, meta-synthesis, knowledge creation, iView, inspiration, imagery thinking, group polarization, group argumentation, graph model, evaluation dynamic recommendation,
data mining, CorMap.

“decision tree pruning”: complexity, privacy protection, decision tree pruning.
“decision analysis”: two-sided matching, incomplete weight information, optimization model, decision analysis.
“knowledge-based systems”: feature recognition, enterprise information system, cad, knowledge-based systems.
“multi-attribute group decision making”: glwowa operator, linguistic information aggregation, multi-attribute group decision making.
“knowledge structure”: order, entropy, order measure model, knowledge structure.

Above addresses possible exploratory analysis of those presentations at MCS 2011.

3. SOM analysis of MCS2011

Self-organizing map is another method for presentations clustering which extract key topics of MCS2011. Figure 5 shows one reasonable result (6 clusters) with initial learning rate=0.095, initial radius=3, 5 × 5 rectangular grid and training number=2000.

The labels of the 6 clusters are “noetic science”(4 presentations), “recommendation system”(2), “knowledge structure”(1), “decision tree pruning”(1) and “multi-attribute group decision making”(2). More detailed information is given as below.

Cluster Numbers: 5

Cluster 1 (label of cluster: “noetic science”): 4 presentations
1) zhongtuo wang -- "study of system intuition by noetic science"
  Keywords: [system intuition, noetic science, imagery thinking, inspiration, tacit knowledge]
2) haolan zhang, christian van der velden -- "utilizing knowledge based mechanisms in automated feature recognition processes"
  Keywords: [knowledge-based systems, feature recognition, enterprise information system, cad]
3) xijin tang -- "meta-synthesis and noetic science"
  Keywords: [meta-synthesis, noetic science, qualitative meta-synthesis, cormap, iview]
4) zhenpeng li, xijin tang -- "group polarization and non-positive social influence : a revised voter model study"
  Keywords: [group polarization, non-positive social influences, social identity, voter model, opinions dynamics]
Fig 5. The SOM analysis result of the keywords and papers

Cluster 2 (label of cluster: recommendation system): 2 papers
1) yongli li, jizhou sun, kunsheng wang, aihua zheng -- "evaluation and recommendation methods based on graph model"
   Keywords: [data mining, evaluation, recommendation system, graph model]
2) xi xia, xiaoji zhou -- "on-demand dynamic recommendation mechanism in support of enhancing idea creativity for group argumentation"
   Keywords: [meta-synthesis, group argumentation, on-demand recommendation, dynamic recommendation, knowledge creation, recommendation system]

Cluster 3 (label of cluster: decision tree pruning): 1 paper
1) mingzheng wang, na ge -- "an improved EDP algorithm to privacy protection in data mining"
   Keywords: [decision tree pruning, privacy protection, complexity]

Cluster 4 (label of cluster: multi-attribute group decision making): 2 papers
1) cuiping wei, xia liang, lili han -- "a new linguistic aggregation operator and its application"
   Keywords: [multi-attribute group decision making, linguistic information aggregation, GLWOWA operator]
2) zhen zheng, chonghui guo -- "a hybrid multiple attributes two-sided matching decision making method with incomplete weight information"
   Keywords: [decision analysis, two-sided matching, optimization model, incomplete weight information]

Cluster 5 (label of cluster: multi-attribute group decision making): 1 paper
1) jiangnan qiu, chunling wang, xuan qin -- "the order measure model of knowledge structure"
   Keywords: [knowledge structure, order, entropy, order measure model]

One hidden cluster (the cluster does not contain any input data) labeled “meta-synthesis”.

Welcome any comments at MCS 2011 online conference ba!