A Fuzzy Web System for Community Building in Complex Environment

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1 Complex Environment and Territorial Relations Network

This contribution deals with the definition of a web-intelligent system able to support social interaction in complex environment, like an Industrial District (ID). Industrial districts, whose main character is the agglomeration of medium/small industries, represented in the past and still represent a successful model of industrial production organization, a sort of Italian way to overcome the difficulties found by the big industry (Albino, 2002).

Several research studies have been realized dealing with ID, emphasizing the role of *spatial aggregation* phenomena, able to create external economies and competitive advantages for firms located inside the ID.

In this perspective, the local territory is able to play an important role in ID development, connecting locale and global through a *versatile integration* process (Beccatini e Rullani, 1993), which create exchanges between local knowledge created by ID firms and knowledge in global network. Therefore, territorial contest could be considered as an experiential contest which allows a continue renewal of practices through innovation processes supported both by social dynamic and interactions with contextual cultural sphere (Camagni, 1989).

The territory represents the physical infrastructure which allows the reiteration of contacts among different local actors. In this perspective, both inter-firm relations and firms-territory relations characterize the ID.

2 Relations Network and Collective Learning Process

In the current economic scenario, characterized by a growing global economic competition among companies and countries, knowledge seems to be a relevant comparative factor: the success is related both to learning capacities and to capabilities to use learning process better than others.

The introduction of learning concept seems interesting because it allows to amply explication models of performances of both individuals and organizations, allowing to adopt knowledge as a causal factor (Calafati, 2002b).

When dealing with complex systems, like ID, I becomes fundamental to adopt a collective perspective in learning process, that is a learning process involving a community of agents is needed. The collective learning concept seems be useful to comprehend relations between changes at individual level to changes at system level (Calafati, 2002b).

Therefore, a systemic approach is requested to analyse cognitive process in complex system as ID. In this approach, intelligence of a human system is not enough to create improvement condition. On one hand, obstacles to implementation of strategy and solution have to be considered. On the other, strategies efficacy of open system depends on environmental characteristics. In this perspective, IDs respect complex systems peculiarity: system characteristics are not derivable from single part characteristics (von Bertalanffy, 1969).

System concept requests to pay attention to system intelligence, that is, to mechanisms able to control system evolution trajectory considering environment constraints-possibilities matrix (Calafati, 2001). As complex systems, local systems evolution is governed by feedback cycles among their elements: each of them has an own evolution dynamic (Bertuglia e Staricco, 2000).

In this perspective, agent interactions become fundamental and learning process could e defined as a change of system relations structure (Calafati, 2002a). Therefore, learning processes are strongly related with communication interaction. In fact, the information emerged from communication improve mental process of the agents enhancing learning process.

Using this approach it can be possible to understand the importance of physical proximity in ID. In fact, along with both shared language and shared social relations, it facilitates agent interactions and structures information flows, influencing, therefore, learning process.

Innovations in Information and Communication Technology seem particularly interesting in our study domain because thet are involving a fundamental systemic component: relation networks (Chiarversio e Micelli, 2000). In fact, ICT tools diffusion could create a remarkable increment of both quantity and type of interactions, between, individuals, organizations and external environment, provoking an increment of evolution dynamics complexity of local systems.

The more relevant potentiality of ICT for local complex system, as ID, regards its capability to greatly amply the individual relational spectrum by:

- Sustaining already existing relational network;
- Improving the creation of contacts with new interlocutors.

Technological innovation processes configure new form of communication processes management which redesign relational system, both effective and potential (Calafati, 2002a). They generate conditions for creation of new cooperation environment, not necessarily local (Chiarversio e Micelli, 2000).

3 Fuzzy Web-based System for Community Creation

This research work, moving from concepts descript in previous pages, deals with definition of a web-base system able to facilitate interaction inside a local community, particularly Industrial District. Research focus is on improvement of logistic in ID by improvement of communication among agents.

To improve those interactions an emarketplace can be used. It could be defined as an electronic agora where a set of persons or agents can be involved in exchanging services and information. The e-marketplaces are today primarily focused on the matchmaking of buyers and sellers. To define the e-marketplace, primarily the two interest communities have to be built up (sellers and providers). To this aim, what is in specific technical literature about the creation of a coalition among intelligent agents is used. A coalition is a set of agents, each one with his own interests, who draw up a cooperation agreement to carry out a piece of work or achieve a goal (Sheory et al., 1998). A group has to be entrusted with a task when single agents cannot carry out sufficiently or at all the same task (Sheory and Kraus, 1998).

The cooperation process can be divided in the following stages:

- finding someone to collaborate with;
- making contact with the selected people;
- building a common understanding: that is, the identification of a goal and the way to reach this goal;
- coordinating activities and work plans through communication among coworkers.

First two stages are emphasized in this research work. In this sense, the communityware research field seems very interesting. In fact, the communityware can be defined as an electronic medium that facilitates the contact with collaborators who have similar interests and preferences, but do not know each other (Raisch, 2001). The communityware has to include essentially three different functions to encourage interactions:

- knowing each other;
- sharing preferences and knowledge;
- generating consensus.

The basic idea is that multiple Internet Agents can form groups of people who share the same interests by analyzing the individual's interests. Resulting clusters can be used for cooperative solution of problems.

As we stated previously, the first step to allow cooperation among unknown agents concerns the contact facilitation, that is the individuation of agents sharing same interests, and making easier the contacts among them. In order to support this process, attributes describing the individuals are required (Raisch,

2001). In this paper, the individuals' attributes concern the attributes of transportation demands: shipment time, destination, type of product, quantity of product, etc.

The algorithm for the coalition formation has some attributes difficult to define in a rigorous way. In fact, to identify the agents able to form the customers' coalition, customers with similar requests, with regard to the shipment date and destinations, have to be considered. The similarity concept seems to be difficult to define using crisp values. In the real world, the human reasoning is based on approximate values or linguistic statements instead of numeric or precise values. Therefore, it seems appropriate to use the fuzzy logic to define the attributes for the coalition formation process. In fact, the fuzzy logic allows performing operation on variables defined in an approximate way and handling variables defined in linguistic terms.

To understand better the use of fuzzy logic in implementation of the proposed system, we focused our attention on the formation process of customers' coalition. The system identifies the possible coalition members comparing different requests and finding possible similarity. In particular, in our research we refer to the Fuzzy Clustering.

Let n be the number of customers, included in the Customers Interest Community, who expressed a request. Split now, on the basis of significant indicators that should characterize each request, these customers into c homogenous subsets (clusters), with $2 \leq c < n$. The customers belonging to anyone of the clusters should be similar to each other, and as dissimilar as possible from the objects of different clusters (Zimmermann, 1991). Classical clustering algorithm, based on bi-value logic, generate partition in which each elements belong or not to a data class. In real world, classes of elements are fuzzy rather than crisp (Dumitrescu et al., 2000). In this sense, "strictly" assign an element to a cluster could be lead to a mistake, because elements are often located *between* classes (Zimmermann, 1991) rather *inside* them.

Currently, this research work deals with definition of a process of fuzzy clustering based on intra-class similarity measure able to build community of interest in ID transportation problem.