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ARTIFICIAL INTELLIGENCE FOR COMMUNICATION NETWORKS

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ABSTRACT
In this paper, we have presented an overview of *swarm intelligence* applied to network routing. Inherent properties of swarm intelligence as observed in nature include: massive system scalability, emergent behavior and intelligence from low complexity local interactions, autonomy, and *stigmergy*, or communication through the environment. These properties are desirable for many types of networks. Swarm intelligent based approaches hold great promise for solving numerous problems of ad-hoc power aware networks. *Swarm intelligence* however is a new field and much work remains to be done. Comparison of the performance of swarm-based algorithms has been done by emulation.

KEYWORDS : massive system scalability, emergent behavior and intelligence .

INTRODUCTION

Routing algorithms in modern networks must address numerous problems. Two of the usual performance metrics of a network are average throughput and delay. The interaction between routing and flow control affects how well these metrics are jointly optimized. Bertsekas and Gallager [1] note that the balance of delay and throughput is determined by the flow-control scheme – good routing results in a morefavorable delay-throughput curve. *Quality of service* (QoS) guarantee is another important performance measure [2,3].

Artificial Intelligence appears in biological swarms of certain insect species. It gives rise to complex and often intelligent behavior through complex interaction of thousands of autonomous swarm members. Interaction is based on primitive instincts with no supervision. The end result is accomplishment of very complex forms of social behavior and fulfillment of a number of optimization and other tasks [4,5]. Main principle of this paper is to study artificial intelligence and its influence on communication networks.

INFLUENCE OF AI ON COMMUNICA - TION :-

The routing table of every node is the same as *AntNet* The update philosophy of the routing table is slightly different though. There is only one class of ants, which is launched from the sources to various destinations at regular time intervals. The ants are eliminated once they reach their destination. Therefore, the probabilities of the routing tables are updated as the ant visits the nodes, based on the life of the ant at the time of the visit. The life of the ant is the sum of the delays of the nodes . The delays D_i are given by $D_{i=c.e}^{-d.s}$ where *c, d* are design parameters and *S* is the spare capacity of each node in the telephone network. Then a step size is defined for that node, according to: $\delta r = \frac{a}{T} + b$, where a and b are both design parameters. This step size rule is chosen heuristically. It assigns a greater step size to those ants who are successful at reaching the node faster. The routing table is then updated according to:

$$r^{i}_{i-1,s}(t+1) = \frac{r^{i}_{i-1,s}(t)+\delta r}{1+\delta r}$$

$$r^{i}_{n,s}(t+1) = \frac{r^{i}_{n,s}(t)}{1+\delta r}, n \neq i-1$$

where s is the source node, i is the current node and i-1 the previous node.

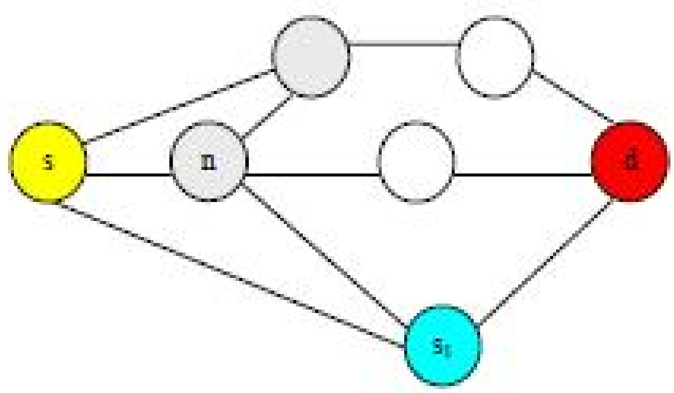
Table I. ABC Routine Table

Destination	Next Hop: B	Next Hop: C
E	0.65	0.35
F	0.55	0.45

Note that the ant both uses and updates the routing table at the same time. For example, in Table I, if the source is node F and the destination is node E, then the ant will update the row for F and use the node for E to find the next hop. It functions as an ant that is both a forward and a backward ant. The update rules are such that the condition $\sum_{n} r^{i}_{n,s} = 1$, where n are all the neighbors to i, is satisfied.

The interesting improvement to this algorithm is based on Bellman's principle of *dynamic programming*. Every node in the path J^k of a source-destination pair s-d, is considered a destination. The back-propagating agent will update the routing table of a visited node n not just for the destination, but also for the intermediate nodes. Hence the updates occur all at once. For example, on node n in Fig. 4, the backward agent will also update the entry for node s_1 as follows:

$$D^{n}_{s_1,s_1}(t) = (1-\eta)D^{n}_{s_1,s_1}(t-1) + \eta d^{k}_{n,s_1}$$



CONCLUSIONS:-

Artificial Intelligence (AI) is one of the newest disciplines which attempts to understand intelligent entities. One reason we study AI is to understand ourselves better. Fields like Philosophy and Psychology also try to do the same, but the difference is that AI not only tries to understand human intelligence, it tries to build human-like intelligent entities as well.

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