Artificial Neural Network in Operation Management Regarding Communication Issue

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INTRODUCTION

Communication through a proper and optimal network by meeting demand in satisfactory level is an important part of decision-making in operation management. Proper and optimal network can be defined in a significant way. The term 'optimal' refers to optimization of cost, use of resources, like fuel, manpower etc. 'Proper' signifies congestion handling. More specifically, the term 'proper' follows the research question "How is congestion reduced in a specific network?" Considering these facts with different motivations and contexts, various decision-making models were developed in this area. Among all these models, ANN based models play a significant role for decision-making. In this chapter, a set of ANN based models are taken into account for analysing the efficacy of ANN as a tool. All the developed ANN based models are not taken as consideration. The specific models are selected based on three following criterion:

- Revolutionary change in goal over earlier models
- Revolutionary change in technical outcome
- Introducing a real scenario in modelling

Before going to the detail of the modelling analysis, a small outline of three major wings- Travelling Sales Problem (TSP), Vehicle Routing Problem (VRP) and Transportation Problem (TP) is given in the following:

Travelling Salesman Problem (TSP)

Travelling Salesman Problem is a combinatorial optimization problem as well as it is NP hard in nature. It is equally important in the area of operation research and operation management. The basic objective

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of this problem is to identify an optimal path for a traveller among a set of cities/nodes. Optimality of network can be described in terms of cost, time, distance etc. But in generally, optimization of cost is taken into account. The crucial assumption of this problem is that each city should be covered once only. Mathematical structure of TSP model is,

$$\text{Minimize } Z = \sum_i \sum_j c_{ij} X_{ij} \tag{1}$$

Subject to

$$\sum_i X_{ij} = 1 \forall j \tag{2}$$

$$\sum_j X_{ij} = 1 \forall i \tag{3}$$

$$X_{ij} \in \{0,1\} \tag{4}$$

The list notations and corresponding significance is given below:

c_{ij} : Cost of travelling through the edge (i, j)

$$X_{ij} = \begin{cases} 1, if\ the\ edge(i,j)\ is\ considered\ in\ optimal\ network \\ 0, Otherwise \end{cases}$$

Equation (1) denotes the objective function of TSP and that is minimization of total cost. Equations (2) and (3) ensure that each city is visited exactly once. Equation (4) represents that the only decision variable X_{ij} is binary in nature.

Transportation Problem (TP)

Transportation Problem (TP) is an optimization based problem. It is very much useful to connect the phases of supply chain. Also, it is useful to each phase of supply chain, i.e. in the cases of multiple production units, multiple retailing units, multiple warehouses etc. It is equally important to the critical issues of operation research. The objective of the problem is to minimize the transportation costs to ship goods from 'm' number of origins to 'n' number of destinations. Here, the transportation costs of goods from origins to destinations are given through a cost matrix. But there should be a balance between demand and supply of products. The LP structure of Transportation Problem is,

$$\text{Minimize } Z = \sum_i \sum_j d_{ij} X_{ij} \tag{5}$$