In our literature survey, we have shown several representative PSO developed for single and multi-objective optimization problems. In the case of single objective PSO we have categorized into several groups by considering various parameters. We observed that most of these methods developed so far are either adopted or inspired by research reported in genetic algorithms literature. There are, however, other methods which are not directly derived from such literature, because they rely on hybridizations between PSO and other meta-heuristics, with the clear aim of benefitting from the advantages of both types of approaches.

The results of the empirical comparative study showed the relative strengths and weaknesses of three state-of-the-art MOPSO algorithms, namely, hypercube algorithm of Coello et al. [28], domination tree algorithm of Fieldsend et al. [52], and k-mediod algorithm of Dehuri et al. [42], after applying them on eight benchmark test functions. Additionally, we obtained better insight of this empirical comparative study by applying these three algorithms to a cantilever design problem. The
experimental results showed that each of these MOPSO algorithms attained a global front and contained good diverse Pareto optimal solutions. However, the k-mediod algorithm was found to better than the other two algorithms both in attaining the diversity and the computation time.

Our proposed binary MOPSO algorithm was applied to solve the NP-hard problem, particularly multi-objective 0/1 knapsack and rule mining problem. We evaluated the performance of our proposed algorithm through an analytic study on Pareto fronts and other graphical illustrations of the experimental results. Particularly, in multi-objective 0/1 knapsack problem, we provided a quantitative basis i.e., set coverage metric. In the rule mining problem, from the graphical illustration of the experimental results on UCI datasets, we observed that there was high reduction in number of rules from rule extraction to rule selection phase for each class of datasets at the same time retaining the high efficiency of the rule classifiers. In other words, the principle of maximization of accuracy versus minimization of complexity was maintained for the construction of rule based classifiers.

As future research directions, though we have taken only three state-of-the-art algorithms to solve the problems, there may be other strategies in the literature whose performances can be evaluated and compared with these three algorithms. Also, we can apply these three algorithms to other real world problems and evaluate their performances.

We can also apply our proposed binary MOPSO algorithms to different domains such as distributed computing, network design, antenna design, etc. We can also extend this algorithm to be implemented on parallel computation problems. We can parallelize this binary MOPSO algorithm for further computation time reduction.
and more improved results. It is also expected many real world problems in discrete
domain can be effectively handled through our proposed novel binary MOPSO algo-
rythm. More extensive validation of the algorithm’s performance is required in other
domains such as biological domain, computational finance domain, etc. Also param-
eter settings may need further fine tuning. Besides, in experimental study, we can
add test functions.