**Appendix**

**Description of parameters and abbreviations**

*Variables*

|  |  |
| --- | --- |
|  | The position and velocity of particle at the th iteration |
|  | The velocity of particle at the th iteration |
|  | The inertia weight in the th iteration |
|  | The position of the optimal particle in the population |
|  | The history optimal position of the particle's |
|  | The random numbers on [0,1] |
|  | The synthetic fitness of the individual |
|  | The number of evaluated points in the neighborhood of the individual |
|  | The weight of evaluated point |
|  | The fitness of the individual calculated on the surrogate model |
|  | The posterior confidence of the surrogate model at the evaluated point |
|  | The conditional probability, which represents the likelihood of the confidence of the surrogate model in the neighborhood of |
|  | The prior confidence of the surrogate model |
|  | The denominator in Bayes' theorem |
|  | The number of times the agent model has predicted the fitness of the selected point at the evaluated point |
|  | At the evaluated point , the surrogate model predicts the fitness of the selected individual for the qth time |
|  | The true fitness of the selected individual |
|  | The distance between individual and the evaluated point |
|  | The membership weight of the attribute |
|  | The hesitation weight of the attribute |
|  | The weight of the attribute , calculated by and |
|  | Intuitionistic fuzzy set form for individual |
|  | The degree of membership of individual on attribute |
|  | The degree of non-membership of individual on attribute |
|  | The ideal plan for intuitionistic fuzzy multi-attribute decision making |
|  | The negative ideal plan for intuitionistic fuzzy multi-attribute decision making |
|  | One of the decision attributes used to select promising point |
|  | One of the decision attributes used to select promising point |
|  | One of the decision attributes used to select uncertain point |
|  | One of the decision attributes used to select uncertain point |
|  | A vector where each scalar is the fitness of individual predicted by the corresponding agent model |
|  | A vector, log-normalized on the basis of |
|  | A Scalar, the log-normalized fitness of individual calculated using BES |
|  | The number of evaluated points in the neighborhood with the most evaluated points |
|  | The maximum Euclidean distance of the nearest evaluated point of all individuals |

*Parameters*

|  |  |
| --- | --- |
|  | Constant, used to control the particles in the PSO |
|  | The number of surrogate models in the RESAPSO |
|  | Parameters to prevent the denominator from being 0 |
|  | The upper bound of the th dimension in search space |
|  | The lower bound of the th dimension in search space |
|  | The dimension of search space |
|  | The radius of the neighborhood in the th dimension |
| FEs | The maximum number of real function evaluations |

*Abbreviations*

|  |  |
| --- | --- |
| PSO | Particle swarm optimization |
| RESAPSO | Reliability-enhanced surrogate-assisted particle swarm optimization |
| IFMADA | Intuitionistic fuzzy multi-attribute decision-making |
| IFS | Intuitionistic fuzzy sets |
| LSTM | Long-short term memory neural network |
| EA | Evolutionary algorithm |
| SAEA | Surrogate-assisted evolutionary algorithm |
| BES | Bayesian evaluation strategy |
| RBFNN | Radial basis function neural network |
| ANN | Artificial neural network |
| PR | Polynomial regression |
| LHS | Latin hypercube sampling |
| BBPSO | Bare bones particle swarm optimization |
| MDEFS | Modified Differential Evolution approach to Feature Selection |
| CDWOASA | Cross-domain whale optimization algorithm with simulated annealing |
| SAGA | Surrogate-assisted genetic algorithm |
| SEODP | Semi-evolutionary algorithm to optimize deep network Hyper-Parameters |
| MadDE | Improving differential evolution with multiple adaptation strategy |
| PGA | Parallel genetic algorithm |
| SAMA/APC | Surrogate-assisted memetic algorithm with adaptive patience criterion |
| SAEGO | Surrogate-assisted enhanced global optimization |
| SMARTEST | Surrogate-assisted memetic algorithm for code Size reduction |
| ReDSADE | Surrogate-assisted differential evolution algorithm with region division |
| GL-SADE | Global and local surrogate-assisted differential evolution algorithm |
| CAL-SAPSO | Committee-based active learning for surrogate-assisted particle swarm optimization |
| SHPSO | Surrogate-assisted hierarchical particle swarm optimization |
| SA-COSO | Surrogate-assisted cooperative swarm Optimization algorithm |
| ESAO | Evolutionary sampling assisted optimization |
| SA-MPSO | Surrogate-Assisted Multipopulation Particle Swarm Optimizer |
| BO | Bayesian Hyperparameter Optimization |