Smart Lora parameters selection

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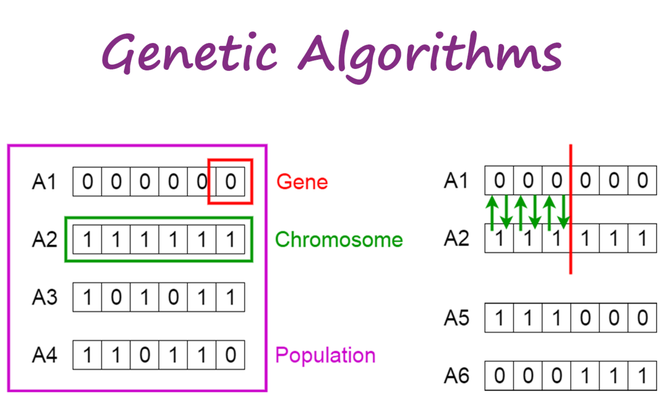
1. Introduction

The need of new kind of wireless communication that could send data far away with low power consumption emrged rencently to support IoT application like smart building smart enviroment monitoring. **LoraWan** is one of this emerging wireless communication [1], it allows sensors to reach the gatheway in a range of 5Km. Unlike other technologies Lorawan is the best versatile sollution to deploaye IoT apllication in both urban and rural area where there is no communication infrastructure.

2. Genetic Algorithm

A genetic algorithm is a search heuristic that is inspired by [2]. This algorithm reflects the process of natural selection where the fittest configurations are selected for reproduction in order to produce offspring of the next generation.

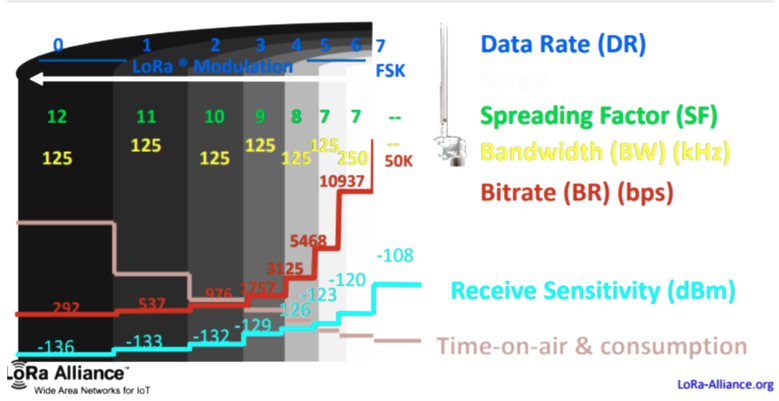
- **Gene:** QoS metric.
- **Chromosome:** QoS of one configuration.
- **Population:** QoS of all configuration.



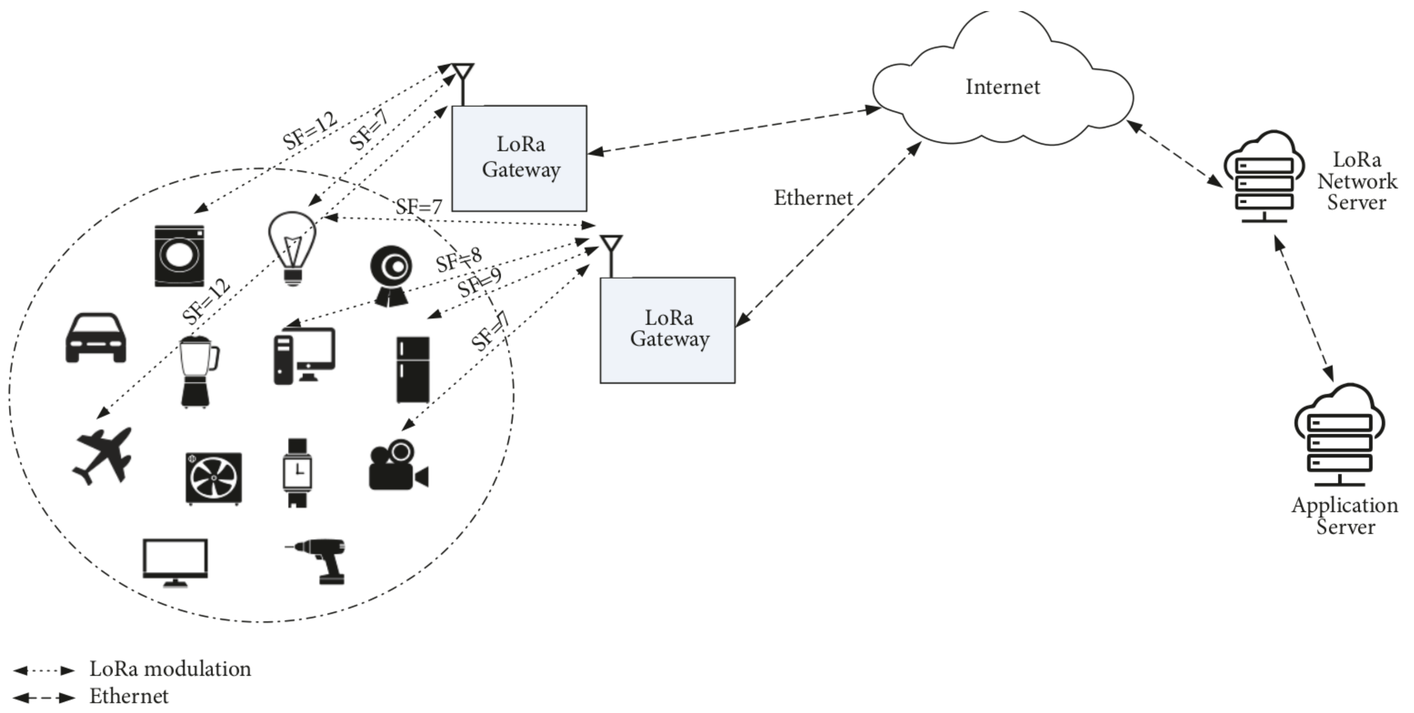
3. Parameters selection

The physicla layer of Lora thecgnology (Semtech SX1276) hase 4 parameters which make 6720 possible settings [3]:

- **SF:** Spreading factor [SF7 - SF12]
- **CR:** Coding rate [4/5 - 4/8]
- **BW:** Bandwidth [7.8Khz - 500Khz]
- **Tx:** Transmition power [-4dBm +20dBm]

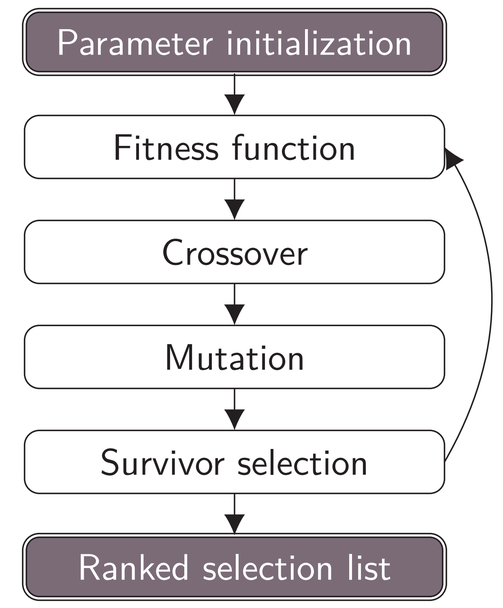


4. Problem statement



5. Algorithm

Definition: stopping criteria, population size P, and mutation probability pm
Generate randomly an initial population of chromosomes
repeat:
. . . **for** each chromosome do
. . . . . . Train a model & compute chromosome's fitness
. . . **end**
. . . **for** each reproduction 1 ... P/2 do
. . . . . . **Select:** 2 chromosomes based on fitness
. . . . . . **Crossover:** Produce 2 child configuration
. . . . . . **Mutate:** child configurations with pm
. . . **end**
until stopping criterion are met



6. Simulation & Results

In order to generate all the required metrics of each Lora configuration we use both simulation and real enviroment. We use ns3 simulator with 2 nodes and one gateway, the distance between each node and the gateway is set to 1km.
Results show that genetic algorithm select the configuration that match beter the requiered QoS by the application. In fact, when we run an application that requires high quality of service, the algorithm select the configuration that gives large BW and hight data rate with minimum enrgy consumption. When we run an application that requiers less QoS, the algorithm rank configuration whith sufficient BW and DR.

Setup	Selection error	Rank	Fitness
1	0.9	1	1.5
2	0.5	3	4.5
3	0.7	2	3
n	0.5	4	6

7. Conclusions

- **Advantages:**

They usually perform better than traditional feature selection techniques. Genetic algorithms can manage data sets with many features. They don't need specific knowledge about the problem under

7. References

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[2] Eleni I. Vlahogianni, Matthew G. Karlaftis, and John C. Golias. Optimized and meta-optimized neural networks for short-term traffic flow prediction: A genetic approach. 13(3):211–234. 00506.

[3] Mahda Noura, Mohammed Atiquzzaman, and Martin Gaedke. Interoperability in Internet of Things: Taxonomies and Open Challenges. 00004.