For feature selection, we used the improved binary particle swarm optimization proposed by Nguyen et al. [] which is Sticky Binary Particle Swarm Optimization (SBPSO). The algorithm used the previous position to update the current particle position by flipping the entry value to zero or one as follows.

(1)

Where represents the iteration number. The SBPSO uses flipping probability instead of velocity. The flipping probability is expressed as follow:

(2)

, is the weight of the sickness, personal best , and global best respectively. Where + . The sickness value indicates how much the position entry will stick with its value, hence the particle will search around. is set to high when the entry just flipped then decrease over a fixed number of steps until the entry flipped or become zero as follow:

(3)

They assume that is the ratio between , . Their value can be expressed as follows:

, (4)

Therefore, the flipping probability will become:

(5)

The following paragraphs illustrate each case:

* The first case: the second and third terms of equation (2) will be zero.
* The second case: the second term in (2) will be zero, and since and are two different binary numbers the absolute value of their difference is one, hence the third term value is then they substitute it by its value in equation (4).
* The third case: the third term will be zero and the second term is . Then they substitute it by its value in equation (4).
* Last case: . The second term is and the third term is . . Hence, the result equation is presented in case 4.

Now, the Flipping probability depends on two parameters and that control the sickness. is a fixed value that is set before starting the algorithm. and are dynamically updated for each iteration as follow:

Where T is the total number of iteration, t is the current iteration U is upper bound, L is lower bound.