Corrections to "Intelligent Traffic Data Transmission and Sharing Based on Optimal Gradient Adaptive Optimization Algorithm"

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IN [1], inaccuracies in several critical equations along with their accompanying descriptions appear in the article. Furthermore, some references are missing, and certain analyses of experiments are flawed.

The results and conclusions presented in the article are based on the corrected equations.

The authors would like to apologize for any inconvenience caused.

The corrections are mentioned as follows:

In Section III, the following text needs to be modified as shown.

On page 13332, the sentence:

"The transportation industry data center acts as one of the exchange sub-nodes of the entire smart cities data center."

should be changed to:

"The transportation industry data center acts as one of the exchange sub-nodes of the entire smart cities data center [43]."

On page 13332, the following sentence:

"Within the transportation industry, data exchange and sharing is mainly aimed at the data exchange and sharing between the transportation bureau and its subordinate departments, such as ..."

should be changed to:

"Within the transportation industry, data exchange and sharing is mainly aimed at the data exchange and sharing between the transportation bureau and its subordinate departments [43]."

On page 13333, the sentence:

"Whenever two CHs come into communication range of each other at the same time, they consider whether to merge their clusters."

should be modified to:

"Whenever two CHs come into communication range of each other at the same time, they consider whether to merge their clusters [44]."

Also, on page 13333, the sentence:

"Before the data is unloaded, the cluster head divides the TP (Transmission Priority) of the data packet."

should be:

"Before the data is unloaded, the cluster head divides the TP (Transmission Priority) of the data packet [44]."

On page 13334:

"The IAP algorithm proposed in this work is to solve the obvious regional differences in energy consumption. It integrates the node energy factor based on the AP algorithm. The specific improvements are as follows:

$$dist'(i,j) = dist(i,j) \times E_{init}^{avg}/E_j^{res} \times \beta \tag{13}$$

In equation (13) above, $dist(i,j)$ denotes that the distance between nodes is close to "intimacy", E_{init}^{avg}/E_j^{res} denotes the energy attraction "intimacy" between nodes, and β refers to the adjustment factor of the number of cluster heads."

needs to be changed to:

"The IAP algorithm proposed in this work is to solve the obvious regional differences in energy consumption. It integrates the node energy factor based on the AP algorithm [45]. The specific improvements are as follows:

$$dist'(i,j) = dist(i,j) \times E_{unit}^{avg}/E_j^{res} \times \beta \tag{13}$$

In equation (13) above, $dist(i,j)$ represents the distance between nodes, E_{unit}^{avg} denotes the average energy of the cluster to which node j belongs, E_j^{res} denotes the residual energy of node j, and β is a factor."

At the bottom of page 13334:

"In the EEMR algorithm, the base station runs the IAP clustering algorithm for network clustering after receiving the information of all surviving nodes. In addition, the EEMR algorithm draws on the dynamics of network clustering in the LEACH protocol, and proposes the ACRR (Adaptive Cluster-head Round Robin) method for local dynamic election of cluster heads. ACRR is a cluster head round-robin strategy based on node adaptability T(s):

$$\mathrm{T}(\mathrm{s}) = \mathrm{T}_1 + \mathrm{T}_2 \times \mathrm{T}_3 + \mathrm{T}_4 \tag{14}$$

$$\mathrm{T}_1 = \mathrm{E}_\mathrm{i}^\mathrm{r}/\mathrm{E}_0 \tag{15}$$

$$\mathrm{T}_2 = \mathrm{E}_\mathrm{i}^\mathrm{r}/\mathrm{E}_\mathrm{i}^\mathrm{unit} \tag{16}$$

$$\mathrm{T}_3 = \left(1 - \mathrm{dist}\,(\mathrm{i}, \mathrm{sink})\,/\mathrm{d}_\mathrm{unit}^{max}\right) \tag{17}$$

$$\mathrm{T}_4 = \mathrm{r}_\mathrm{m}/\left(\mathrm{r}+1\right) \tag{18}$$

In the above equations, T1 and T2 represent the absolute proportion of the node's remaining energy and the relative proportion of the node's energy in the cluster to which it belongs, respectively; T3 refers to the relative distance ratio of the distance between the node and the base station in the cluster to which it belongs; and T4 is the ratio of the node that does not serve as the cluster head continuously in the cluster to which it belongs."

should be changed to:

"In the EEMR algorithm, the base station runs the IAP clustering algorithm for network clustering after receiving the information of all surviving nodes. Additionally, drawing inspiration from the network clustering dynamics in the LEACH protocol, the EEMR algorithm incorporates the ACRR (Adaptive Cluster-head Round Robin) method for the local dynamic selection of cluster heads [45]. ACRR operates as a cluster head round-robin strategy, employing node adaptability $T(i)$:

$$T(i) = T_1 + T_2 \times T_3 + T_4 \tag{14}$$

$$T_1 = E_i^{res}/E_i^{init} \tag{15}$$

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$$T_2 = E_i^{res}/E_i^{unit} \tag{16}$$
$$T_3 = \left(1 - dist\,(i, sink)\,/d_{unit}^{max}\right) \tag{17}$$
$$T_4 = r_m(i) \tag{18}$$

where, E_i^{res} denotes the residual energy of node i, E_i^{init} denotes the initial energy of node i, E_i^{unit} denotes the total energy of the cluster to which node i belongs, dist (i, sink) denotes the distance between node i and the sink node, d_{unit}^{max} represents the maximum distance within the cluster to which node i belongs, and $r_m(i)$ denotes the number of rounds that node i does not serve as the cluster head continuously in the cluster to which it belongs."

On page 13335:

"The core of the EEMR algorithm is to avoid the control energy cost caused by frequent clustering, and a hierarchical multi-hop data forwarding strategy based on node competence is proposed. The relay cluster head is determined based on node competence f(s). If $\mathrm{E_s^{cur}}$ is the residual energy of the cluster head s, and θ is the data transmission deflection angle, the calculation equation of f(s) can be expressed as:

$$\mathrm{f\,(s)} = \lambda_1 \left(\mathrm{E_s^{cur}/E_{init}}\right) + \lambda_2 \left(\mathrm{dist\,(i, s)\,/R_h} \times \cos\theta\right) \tag{19}$$

λ_{i} in the above equation represents the weight coefficient of each competency factor."

should be modified to:

"The core of the EEMR algorithm is to avoid the control energy cost caused by frequent clustering, and a hierarchical multi-hop data forwarding strategy based on node competence is proposed. The relay cluster head is determined based on node competence f(s) [45]. If $\mathrm{E_s^{cur}}$ is the residual energy of the cluster head s, and θ is the data transmission deflection angle, the calculation equation of f(s) can be expressed as:

$$f\,(s) = \lambda_1 \left(E_s^{cur}/E_s^{unit}\right) + \lambda_2 \left(dist\,(i, s)\,/R_h \times \cos\theta\right) \tag{19}$$

where E_s^{cur} denotes the current energy of cluster head s, E_s^{unit} denotes the total energy of the cluster to which the node s belongs, and λ_i denotes the weight coefficient."

Also, on page 13335:

"The mini-batch gradient descent method is adopted to solve the network parameters."

needs to be modified to:

"The mini-batch gradient descent method is adopted to solve the network parameters [46]."

On page 13336:

"Based on the above basis, the concept of adaptive friction coefficient is adopted to the Adam algorithm, and a new adaptive algorithm can be obtained, which is called the TAdam algorithm. The update rule of the TAdam algorithm is given as follows:

$$\mathrm{m_t} = \beta_1 \mathrm{m_{t-1}} + (1 - \beta_1)\,\mathrm{g_t^2} \tag{32}$$
$$\mathrm{v_t} = \mathrm{v_{t-1}} - (1 - \beta_2)\tanh\left(\mathrm{v_{t-1}} - \mathrm{g_t^2}\right)\mathrm{g_t^2} \tag{33}$$

should be changed to:

"Based on the above basis, the concept of adaptive friction coefficient is adopted to the Adam algorithm, and a new adaptive algorithm can be obtained, which is called the TAdam algorithm [46]. The update rule of the TAdam algorithm is given as follows:

$$\mathrm{m_t} = \beta_1 \mathrm{m_{t-1}} + (1 - \beta_1)\,\mathrm{g_t} \tag{32}$$
$$\mathrm{v_t} = \beta_2 \mathrm{v_{t-1}} + (1 - \beta_2)\tanh\left(\mathrm{v_{t-1}} - \mathrm{g_t^2}\right)\mathrm{g_t^2} \tag{33}$$

where β_1 and β_2 are the exponential decay coefficients of the first and second moments, respectively."

In Section IV, Results and Discussions, the following sentences should be changed:

From:

"Vehicles that unload data based on the traditional transmission mode directly establish a connection with the edge server, and the tasks to be processed are directly offloaded to the MEC for processing. The network coverage of MEC is 120 meters and the coverage radius is 60 meters."

To:

"Vehicles that unload data based on the traditional transmission mode directly establish a connection with the edge server, and the tasks to be processed are directly offloaded to the MEC for processing. The network coverage of MEC is 120 meters and the coverage radius is 60 meters [44]."

Also:

"Figure 8 shows the relationship between system energy consumption and the proportion of a given failed node under the five algorithms. It shows that the energy consumption rate of the LEACH algorithm and the UCR algorithm is too fast in the first half, and the energy consumption rate in the second half gradually tends to be slow. During about 1,200 rounds of data collection, the node energy consumption rate of the proposed EEMR algorithm and BUC algorithm is relatively stable, and the energy consumption in each round of data collection is lower than that of the LEACH algorithm and the UCR algorithm. Overall, the EEMR algorithm has the lowest average energy consumption per round of data collection, thus significantly extending the network working time. The BUC algorithm and the EEMR algorithm control the low energy consumption in each round of data collection due to their stable network clustering mechanism and realize the energy balance of network nodes through a reasonable data forwarding strategy. Moreover, in the 1,500 rounds of data collection, the network surviving nodes of the EEMR algorithm are still as high as 90%, while the network surviving nodes of the BUC algorithm are only 30%. It is further explained that the EEMR algorithm achieves the energy balance of the network nodes as much as possible while minimizing the system energy consumption. The EEMR algorithm effectively solves the limited communication and too fast energy consumption in the DT transmission mode. The clustering method based on energy level avoids the system overhead caused by frequent clustering and random cluster selection, and greatly prolongs the network operation duration.

Next, the average energy consumption under the five data collection algorithms is compared, as shown in Figure 9. The consumption of the EEMR algorithm and the BUC algorithm is relatively stable. When the node failure ratio is less than 0.4, the average energy consumption of the two algorithms is lower than that of the LEACH algorithm and the UCR algorithm."

should be changed to:

"Figure 8 illustrates the correlation between system energy consumption and the proportion of failed nodes across the five algorithms. It is evident that the energy consumption rate of the LEACH, UCR, and SHDC algorithms outpaces that of the EEMR and BUC algorithms. Within approximately 1,400 rounds of data collection, the node energy consumption rate remains relatively stable for both the EEMR and BUC algorithms. Moreover, their energy consumption per round is lower compared to the other three algorithms. Both the BUC and EEMR algorithms maintain low energy consumption per round through their stable network clustering mechanism and employ a rational data forwarding strategy to achieve energy balance among network nodes. Notwithstanding, the EEMR algorithm exhibits the lowest average energy consumption per round of data collection, outperforming the BUC algorithm due to its meticulous consideration of energy distribution among distinct clusters, thus ensuring balanced energy consumption across clusters. Importantly, after 1,600 rounds of data collection, the EEMR algorithm maintains approximately

90% of network nodes as survivors, contrasting starkly with the BUC algorithm's mere 30% survival rate. This further underscores the efficacy of the EEMR algorithm in maximizing energy balance among network nodes while concurrently minimizing system energy consumption. The EEMR algorithm effectively addresses the challenges of limited communication and rapid energy consumption in the DT transmission mode. By employing a clustering method based on energy levels, it circumvents the system overhead associated with frequent clustering and random cluster selection, thereby significantly extending the network's operational duration [45].

Subsequently, the average energy consumption across the five data collection algorithms is compared, as depicted in Figure 9. Notably, the EEMR algorithm exhibits consistently low energy consumption irrespective of the Proportion of Failed Nodes. Conversely, the BUC algorithm demonstrates lower consumption compared to the other three algorithms when the node failure ratio is below 0.4. However, as the node failure ratio surpasses 0.6, the average energy consumption of LEACH, UCR, and SHDC becomes lower than that of BUC."

In addition, the sentence:

"As demonstrated in Figure 11, SGD, Adam, and the improved TAdam in this work all achieved about 100% accuracy on the MNIST dataset. Moreover, the convergence speed of the TAdam algorithm proposed in this work is faster than other adaptive algorithms, and it reaches 100% accuracy at about the 10th epoch. In the test set, the training accuracy rates of several algorithms are quite different, and the Adam algorithm has the worst performance, with the worst stability and training accuracy. The TAdam optimization algorithm shows high stability in the whole process."

should be modified to:

"Figure 11 illustrates that SGD, Adam, and the enhanced TAdam algorithm in this study all attained approximately 100% accuracy on the MNIST dataset. Notably, the TAdam algorithm introduced in this research exhibits superior convergence speed compared to the other two algorithms, achieving 100% accuracy around the 10th epoch. In contrast, SGD demonstrates the slowest convergence, requiring approximately 100 epochs to reach 100% accuracy on the training dataset [46].

Conversely, regarding the test set, significant disparities exist in the accuracy rates among various algorithms, with the Adam algorithm exhibiting the poorest performance characterized by inferior stability and accuracy. In contrast, the TAdam optimization algorithm demonstrates remarkable stability throughout the process. This is attributed to the introduction of the friction factor, which mitigates parameter oscillations during optimization, thereby rendering the entire process smoother."

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