Artificial Bee Colony Algorithm-Based Ultrasound Image Features in the Analysis of the Influence of Different Anesthesia Methods on Lung Air Volume in Orthopedic Surgery Patients

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This study aimed to provide a quantitative evaluation of the lung gas content in orthopedic surgery patients under different anesthesia using ultrasound images based on the artificial bee colony algorithm. The ultrasound image features based on an artificial bee colony algorithm were applied to analyze segmentation images to investigate the influence of different anesthesia methods on the lung air content of patients undergoing orthopedic surgery and the clinical features of such patients. They were also adopted for the anesthesia in orthopedic surgery to assist clinicians in the diagnosis of diseases. 160 orthopedic surgery patients who were hospitalized were treated with different anesthesia methods. The first group (traditional general anesthesia group) received general anesthesia and traditional ultrasound; the second group (ABC general anesthesia group) was used for ultrasound image analysis based on the artificial bee colony algorithm; the third group (traditional sclerosis group) was anesthetized with combined sclerosis block; ultrasound images of patients from the fourth group (ABC sclerosis group) were analyzed based on the artificial bee colony algorithm. Analysis was conducted at three time points. The LUS score of the traditional sclerosis group and ABC sclerosis group was hugely higher than the score of the traditional general anesthesia group and ABC general anesthesia group at T2 time, with statistical significance ($P < 0.005$). At time point T3, the score of the traditional sclerosis group rose greatly compared with the general anesthesia group, and that of the ABC group was generally higher than that of the traditional ultrasound group ($P < 0.05$). When the threshold value was 4, the fitness value of ABC algorithm was 2680.4461, and the fitness value of the control group was 1736.815. The difference between the two groups was 943.6311 ($P < 0.05$). The operation time of ABC algorithm was 1.83, while that of the control group was 1.05, and the difference between the two groups was 0.78 ($P < 0.05$). In conclusion, the feature analysis of ultrasonic images based on the artificial bee colony algorithm could effectively improve the accuracy of ultrasonic images and the accuracy of focus recognition. It can promote medical efficiency and accurately identify the lung air content of patients in future clinical case measurement and auxiliary treatment of fracture, which has great application potential in improving surgical anesthesia effect.

1. Introduction

Nowadays, with the development of economy, science, and technology, the social population is gradually increasing, and the cases of fracture surgery in the elderly have become more and more common [1]. For the leg bone surgery, lumbar anesthesia joints (such as central nervous system diseases, chronic degenerative disease of the spinal cord, disease of intracranial pressure, serious infection that might be caused by an anesthetic puncture, spinal cord injury, or severe low back pain and mental illness), general anesthesia, and external anesthesia can achieve effective anesthesia effect.
and can be operated smoothly [2]. For patients suffering from hard lumbar joint anesthesia, the lumbar anesthesia works faster, the effect is more accurate, the amount of anesthesia required is small, the anesthesia level is easy to control, and it is beneficial to postoperative pain relief for patients with general anesthesia. Studies have shown that even before anesthesia in patients with lung disease, lung function, and normal patients, there is a certain degree of damage to ventilation function and respiratory mechanics after surgery, and the incidence of atelectasis is about 90% [3]. This phenomenon is caused by the use of common anesthetics and the effect of breathing during general anesthesia. The movement of patients’ respiratory muscles can be affected to reduce lung ventilation. A high dose of anesthetic can not only increase the depth of anesthesia but also block the excitability of nerve conduction [4]. Meanwhile, the transparency of pulmonary capillaries is increased while the release of surfactant in alveoli is decreased. On the other hand, due to the great influence of breathing and ventilation in patients under anesthesia, muscle tension disappears, increasing respiratory resistance and shear injury under alveolar collapse, which leads to poor lung function in patients, and some patients also develop airless lungs, pulmonary branch tubes, and gas exchange disorders [5].

In clinical practice, it is found that traditional computed tomography (CT) is very difficult to detect atelectasis, and the diagnosis can only be made when the images are obvious in the occurrence of multiple diseases. However, since CT is radioactive and expensive, the examination site can only be at a selected point, so ultrasound has advantages [6]. Some studies have pointed out that pulmonary ultrasound has a clinical value corresponding to the location of the original lesion. In an ultrasound examination, pulmonary fibrosis can be detected by preobservation of pulmonary gas composition by ultrasound under epidural anesthesia and under general anesthesia [7]. Some studies have pointed out that lung ultrasound has a clinical value corresponding to the original lesion location. In the ultrasound examination, lung fibrosis can be detected by preobservation of lung gas composition using ultrasound under epidural anesthesia and general anesthesia.

Lung is the main gas-containing organ of the human body. Due to the physical characteristics of ultrasound itself, total reflection occurs when gas is encountered on the path of transmission, resulting in the failure of ultrasound imaging for normal lung tissue. However, in pathological state, the ratio of air-fluid in lung tissue will change, and abnormal signs such as artifacts may appear in the process of ultrasound examination, which is based on the analysis of such artifacts. Lung ultrasonography (LUS) mainly includes 10 basic signs, that is, normal lung signs (bat sign, pleural sliding sign, A-line), pleural effusion signs (quadrilateral sign, sine wave sign), lung consolidation signs (debris sign, tissue sign), interstitial syndrome (lung rocket sign), and pneumothorax (stratospheric sign, pulmonary point). In recent years, with the continuous development of ultrasound technology, ultrasound diagnosis of lung diseases has become an important means of examination and monitoring of treatment effect in the world. It has realized the visualization of the pathological physiology of the lung and is known as a visual “stethoscope.”

In the past 30 years, with the rapid development of medical image technology, medical image segmentation technology has become one of the hot research fields of scholars. It has been continuously improved and updated and has become an important situation in the field of medical image analysis. Doctors use medical images to analyze patient pathology and research, playing a more important role. Countries around the world have invested a lot of money and skilled people to carry out detailed studies. In foreign countries, Liu et al. [8] proposed a real coded genetic algorithm, which took into account the multi-threshold problem and segmented the brain medical images. This method has a good segmentation effect for images with low standard deviation and high maximum entropy, and more thresholds improve the segmentation effect. Zhang [9] proposed a new multithreshold segmentation algorithm for the high time complexity and longtime consumption of the multithreshold segmentation algorithm. Firstly, all gray levels are set as thresholds, and the histogram of the original image is divided into 256 small areas so that each area corresponds to the gray level. The new design scheme is then used to merge the two adjacent areas for each iteration. To improve the accuracy of the merging operation, scatter and probability are used as the energy. According to the research of Li et al. [10], medical images have many complicated imaging mechanisms and other unstable factors. Due to the displacement of the object, structural defects occur, partial volume effects cause errors or device wear, and the complexity of image processing is greatly increased. To eliminate the effects of structural defects and noise through the similarity of features in the preprocessing stage, an ultrasonic image segmentation method based on the artificial bee colony algorithm was proposed in this study. According to the features of learning bee colony, the time of lung image segmentation was greatly reduced and the accuracy of lung ultrasound was improved, which provided an effective basis for rapid diagnosis by experts. There was an observation of the effects of different anesthesia methods on postoperative changes of lung air volume in patients undergoing fracture surgery. Therefore, it was necessary to comprehensively consider the reduction of postoperative pulmonary complications and the effectiveness of anesthesia, thereby guiding the clinical selection of more appropriate anesthesia methods.

2. Methods

2.1. Research Objects. From April 2017 to April 2020, a total of 160 cases of ultrasonic lung air content were observed under general anesthesia and sclerosis block anesthesia. Among them, there were 95 males and 65 females with a height of 160–185, a weight of 55–90 kg, an age of 25–36, and a BMI of 19–26 kg/m². Adults were selected for the study and divided into the general anesthesia group (n = 80) and the sclerosis block group (n = 80) according to the different anesthesia methods. Besides, they were divided randomly
into the artificial bee colony algorithm ultrasound group (ABC group) and the traditional ultrasound control group (control ultrasound group), 40 cases in each group.

The criteria for inclusion were defined to include patients who had American Association of Anesthesiologists (ASA) classification \( \leq 3 \), were adults, and underwent orthopedic surgery during the study period.

The criteria for exclusion were defined to exclude patients who suffered from respiratory diseases, had poor compliance and noncooperation, and had ASA classification greater than 3.

In this study, 160 orthopedic patients met the above inclusion criteria. This study was approved by the Medical Ethics Committee of the hospital, and the family members of the patients included in the study signed an informed consent form.

2.2. Artificial Bee Colony Algorithm. Under normal circumstances, the bee society is composed of queen bees, drones, and worker bees. In the bee colony, the number of bees varies from 10,000 to 60,000 bees of various kinds, which perform different functions. The above three types of bees have their own work assignments in the bee hive. Moreover, the relationship between them is a close organization and an absolute superiority of the affiliation of the army [11].

As shown in Figure 1, the artificial bee algorithm is a new intelligent optimization algorithm that simulates the honey collection process of bees. In the artificial bee algorithm, new food sources near the food source are explored and choices are made according to the information conveyed by the lead bee [12, 13].

Table 1 shows the bee foraging and artificial algorithm corresponding procedures. In the artificial bee colony algorithm, the artificial bee colony is divided into three types: lead bees, follow bees, and detective bees. In the search, the lead bees and follow bees successively mine food sources, that is, to find the optimal solution, while the detective bees observe whether they fall into local optimum, and if they fall into local optimum, they randomly search for other possible food sources. Each food source represents one possible solution to the problem, and the nectar amount of the food source corresponds to the quality of the corresponding solution (fitness value \( \text{fit} \)). In the search process of the artificial bee colony algorithm, initialization is required firstly, including determining the population numbers, the maximum number of iteration times (MCN), and the control parameter limit and determining the search space, i.e., the range of the solution. In the search space, the initial solution \( x_i \) \( (i = 1, 2, 3, \ldots, \text{SN}) \) is generated randomly, where \( \text{SN} \) is the number of food sources, each solution \( x_i \) is a \( d \)-dimensional vector, and \( D \) is the dimension of the problem. After initialization, the entire population will repeat the search process of the lead bee, follow bee, and detective bee until it reaches the maximum number of iterations (MCN) or the allowable error \( \varepsilon \).

At the beginning of the search process, each leading bee by equation (1) produces a new solution, which is a new food source.

\[
V_{ij} = x_{ij} + \Phi_{ij} (x_{ij} - x_{kij}),
\]

where \( x_{ij} \) is the current solution; the position of food in the current stage is \( k \in \{1, 2, \ldots, \text{SN}\}, j \in \{1, 2, \ldots, D\} \); \( \Phi_{ij} \) is a random number within \([-1, 1]\); and \( x_{kij} \) is the index of random search by the hired bees. The \( \text{fit} \) of the new solution is calculated and evaluated. If the \( \text{fit} \) of the new solution is better than the old solution, the lead bee will remember the new solution and forget the old solution. Otherwise, it will retain the old solution.

After all the queen bee search process is completed, the lead bee begins to swing and share the location of the source of honey. The selection probability of each solution is calculated according to the following equation:

\[
P_i = \frac{\text{fit}_i}{\sum_{l=1}^{\text{SN}} \text{fit}_l}.
\]

Next, \( p_i \) is the probability that the spectator bees were assigned to choose; random numbers are generated in the interval \([-1, 1]\). If the probability value of the solution is larger than any number, (3) is employed to generate a new solution and test the new solution \( \text{fit} \). If the \( \text{fit} \) of the new solution is better than the previous one, the bee below remembers the new solution and forgets the old one. If the method is not good, the old solution will be maintained.

\[
x^j_i = x^j_{\text{min}} + \text{rand}(0, 1)(x^j_{\text{max}} - x^j_{\text{min}}),
\]

where \( x^j_{\text{min}} \) is the lower boundary of the solution in dimension \( j \), \( x^j_{\text{max}} \) is the upper boundary of the solution in dimension \( j \), and \( x^j_i \) is the corresponding solution of the hired bee transformed into the scout bee. In (3), \( j \in \{1, 2, \ldots, D\} \). Then, the search for the lead bee starts the cycle again. The number of food sources for the artificial bee algorithm will be larger, and the larger the \( \text{fit} \) value, the better. Optimization needs to be considered in both the minimum problem and the maximum problem. Similarly to the final solution of the optimization problem, in the case of the optimization minimum problem, the matching degree function is a modification of \( f_i \) expressed by the general equation (4). If the biggest problem is optimized, the final explanation is the desired function.

\[
\text{fit}_i = \begin{cases} 
\frac{1}{1 + f_i}, & f_i > 0 \\
1 + \text{abs}(f_i), & f_i \geq 0
\end{cases}.
\]

The worker bee colony algorithm generally makes a greedy selection when evaluating food sources according to the following equation:

\[
v_i = \begin{cases} 
x_i \text{fit } (v_i) > \text{fit } (x_i) \\
x_i \text{fit } (x_i) > \text{fit } (v_i)
\end{cases}.
\]
The purpose of an artificial bee colony algorithm is to find the optimal food source or optimal solution through a circular search.

2.3. The Concrete Realization Steps of the Worker Bee Colony Algorithm

Step 1. Initialize the population: each parameter is initialized, such as the total number of bee colonies (SN) and the number of times the food source is collected (the maximum number of iterations (MCN) and the control parameter limit); the problem search range is determined; and an initial solution $x_i$ ($i = 1, 2, \ldots, SN$) is randomly generated.

Step 2. Calculate and evaluate the fitness of each initial solution.

Step 3. Set the program conditions and start the loop.

Step 4. Calculate the coincidence value according to the bee solution equation (1) to generate a new solution (food source).

Step 5. Make a selection based on (5): if the suitable value of $v_i$ is better than the suitable value of $x_i$, $v_i$ replaces $x_i$ and $v_i$ is used as the current best solution; otherwise, do not change $x_i$.

Step 6. Calculate the probability of food source $p_i$ according to (4).

Step 7. According to the bees, the source of the solution or the source of food is selected according to the probability faction; the adaptability of the new solution (food source) $v_i$ is calculated according to (1) retrieval.

Step 8. Make a greedy choice according to (5). If the adaptability of $v_i$ is better than that of $x_i$, please replace $x_i$.

Table 1: Bee foraging and artificial algorithm corresponding procedures.

| Swarm honey-gathering behavior | Specific optimization problem |
|-------------------------------|------------------------------|
| Food source                   | The feasible solution of the optimization problem |
| Location of food sources      | The location of the solution |
| The nectar amount of the food source | Fitness values in optimization problems |
| The process of finding and gathering food sources | Problem-solving process |
| Maximum nectar volume of food source | The optimal solution to the problem |

Figure 1: Route map of bee foraging and collection.
with \( vi \) and use \( \bar{vi} \) as the current best solution. Otherwise, please do not change \( xi \).

**Step 9.** Determine whether there is a solution to be abandoned. If yes, the investigating bee randomly generates a new solution according to (5) and replaces the old one.

**Step 10.** Record the best solution so far.

**Step 11.** Determine whether the loop termination condition is met; if it is satisfied, the loop ends, and the optimal solution is output; otherwise, return to Step 4 to continue searching.

Under the condition of signal to noise ratio (SNR) of 20 dB, 10 dB, 5 dB, and 0 dB, three groups of different initial values were selected to estimate the ultrasonic echo parameters based on Gaussian model. The configuration of the computer simulation experiment platform was as follows: Pentium® dual-core E5700 processor, main frequency of 3.00 GHz; 2.0 GB of memory; Windows XP Professional 32-bit SP3 operating system, Lab7 version 1.0.

### 2.4. Anesthesia Method

**2.4.1. General Anesthesia.** The indicators of patients were monitored, including ECG, \( \text{SPO}_2 \), pulse, blood pressure (BP), and end of partial expiratory pressure of carbon dioxide (PETCO2). Rapid induction of anesthesia was performed using oxygen at a rate of 3 mg/min. The following were applied in the surgery: etomidate (Enhua Pharmaceutical Co., Ltd., Xuzhou), 0.1–0.3 mg/kg; fentanyl (Renfu Pharmaceutical Co., Ltd., Yichang), 4–7 μg/kg; and rocuronium bromide (NV Organon Company, Netherlands). Intraoperative maintenance of anesthesia was done as follows: remifentanil 0.1–0.3 μg/(kg·min), sevoflurane (Abbott Laboratories, USA), and propofol (AstraZeneca, Inc.) were adjusted for BP and heart rate (HR) during surgery. Before extubation after anesthesia, the trachea was extracted after secretion and suction through the mouth and airway. Oxygen was inhaled for the second time after surgery, and the flow rate was 3 L/min.

**2.4.2. Sclerosis Combined Block Anesthesia.** After the patient entered the room, the ECG, pulse, noninvasive BP, \( \text{SpO}_2 \), and other indicators were routinely monitored; each patient was given oxygen to the mask, and the oxygen flow was 4 L/min. In the left decubitus position, sclerosis combined block anesthesia tube was placed in the L3-4 space, and 0.6% bupivacaine (Shanghai Fosun Zhaohui Pharmaceutical Co., Ltd., Shanghai) was slowly pushed into the body. After the surgery, the patient was transferred to the resuscitation room with an oxygen flow rate of 4 L/min.

**2.5. Ultrasonic Testing.** The research objects were asked to lie supine for 2 hours, and it was forbidden to turn over and swing the body while lying supine. Ultrasonic images of the lungs of the research objects were collected before and after lying supine for 2 hours (portable two-dimensional ultrasound instrument, Micro MA HFL386, SonoSite Company), the frequency of the convex array probe was 2–5 MHz (SonoSite Company), and the medical ultrasonic coupling agent (KL-250) (Capulla Medical Equipment Co., Ltd.) was adopted. The image acquisition study of lung ultrasound was completed by 4 people, of whom 2 were responsible for collecting all the lung ultrasound images, and the other 2 were responsible for evaluating the lung ultrasound images. A double-blind method was adopted between the collected images and the evaluation images, and the average score of the 2 evaluators was finally obtained.

**2.6. Observation Indicators.** The semi-quantitative scoring ring was adopted to score the lung ultrasound examination to determine the degree of lung volume reduction. The lung ultrasound score of one area was 0–3 points, and the total score of the whole lung was 0–36 points. In other words, the total score of the whole lung was 0–36 points. 0 was the normal air content. The higher the score of LUS is, the more significant the reduction of lung volume is. Moreover, 36 points of LUS indicated a complete loss of lung capacity. See Table 2 and Figure 2.

The awakening score was applied to LUS scoring criteria, as shown in Table 3.

**2.7. Statistical Methods.** SPSS20.0 was used for analysis and statistics. Normally distributed measurement data were expressed as mean ± standard deviation. One-way analysis of variance was used for comparison between groups, independent sample \( t \)-test was used for general data, and paired sample \( t \)-test was adopted to compare healthy volunteers’ lung LUS scores at different times. In addition, \( P < 0.05 \) indicated that the difference was statistically substantial.

### 3. Results

**3.1. Visual Evaluation of the Accuracy Results of Deep Learning Model Images and Nonartificial Intelligence Images.** Figure 3 shows, from left to right, the original image, the traditional ultrasound segmentation image, and the ABC method segmentation image; Figure 4 shows the data result. The results indicated that the gray histogram of the original image mostly concentrated between pixel 25 and pixel 160, presenting a state of high in the middle and low on both sides, indicating that the gray value is relatively average. After traditional ultrasound segmentation image processing, the image accuracy became worse, and the focus was not clear; the ABC algorithm details increased, and the image became clearer.

In Figures 5 and 6, the fitness value obtained by ABC algorithm after image segmentation when the threshold value was 2 was 1992.6178, and the fitness value of the control group was 1577.6178, with a difference of 415 between the two groups, showing a statistical difference (\( P < 0.05 \)). However, when the threshold value increased, the fitness value obtained by the algorithm after cell image segmentation was more different from that of the control.
Table 2: Lung ultrasound image scoring standards.

| Score | Ultrasonic image presentation |
|-------|-------------------------------|
| 0     | Clear A-line and lung slip signs or 0–2 B-lines |
| 1     | More than or equal to 3 B-lines or small subpleural consolidation separated by smooth pleural lines |
| 2     | Multiple B-line concomitant or subpleural lines separated by thickened, irregular pleural lines are present |
| 3     | Consolidation of the small |
|       | >1 × 2 cm subpleural consolidation |

Figure 2: Ultrasound signs of the lungs with different scores (Note: in Figure 2(a), P means the thoracic cavity line and A means line A. In Figure 2(b), the scatter high-echo image starting from the rib line was line B. According to the LUS scoring standard, the score was 1 point. In Figure 2(c), the chest cavity was not smooth, and there were small irregular shadows under the chest cavity. Fusion line B was from the chest cavity. According to the LUS scoring standard, the score was 3 points. In Figure 2(d), the shadow was further increased, and the shadow area was more than 1 × 2 cm; the symptoms of the air bronchus could be observed. According to the LUS scoring standard, it was 3 points.).

Table 3: Awakening score.

|                  | 0                                   | 1                                   | 2                                   |
|------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Mobility of limbs| No autonomous activity               | Move both limbs                     | Limbs activity                      |
| Breathing        | No or faint exhalation suction       | Shallow breathing, breathing limit   | Deep breath, frequency              |
| Blood pressure changes | Was higher than before anesthesia ±50% | ±15–50%                              | Degree of normal                    |
| Consciousness    | There is no response                 | Can be awakened                      | Anesthesia before ±20%              |
| SpO₂             | Oxygen gas < 92%                     | Oxygen gas ≥ 92%                     | Awake                               |
|                  |                                     |                                     | Suction air ≥ 92%                   |
group. When the threshold value was 4, the fitness value of ABC algorithm was 2680.4461, and that of the control group was 1736.815. The difference between the two groups was 943.6311, with statistical difference ($P < 0.05$). The fitness value fluctuation range of traditional segmentation was the smallest, while the fitness value fluctuation of ABC algorithm was relatively large. The operation time of ABC algorithm was 1.83, while that of the control group was 1.05. The difference between the two groups was 0.78, showing a statistical difference ($P < 0.05$). Traditional algorithm took the longest time to run, while ABC algorithm took a short time, so it could obtain efficient segmentation results and accurate time.

3.2. LUS Score at Three Time Points. There was no huge difference in the LUS scores of the four groups at T1 time. The LUS scores of the traditional sclerosis group and the ABC sclerosis group at T2 time were higher substantially than the scores of the traditional general anesthesia group and the ABC general anesthesia group, with a statistically significant difference. In addition, the scores of sclerosis group at T3 were higher than those of the general anesthesia group, and the scores of the ABC group were generally higher than those of the traditional ultrasound group, with statistical significance (Figure 7).

3.3. LUS Scores for Each of the Four Groups at Each Time Point. As shown in Figure 8, there was no obvious difference in each zone at T1 time. At T2 and T3, the scores of LUS in the
Figure 7: Comparison of the LUS scores at three time points (*the difference between the groups is statistically significant, \( P < 0.05 \)).

Figure 8: Continued.
Figure 8: Continued.
In fracture surgery, elderly patients are susceptible to many systemic diseases due to the decline of their body functions, lung function also has varying degrees of decline, respiratory function declines, and systemic immunity reduces; lung air content decreases after surgery, and complications in the lungs become prone to occur [14]. At present, the gold standard for clinical diagnosis of lung consolidation and atelectasis is still lung CT, but defects such as radiation damage, price increase, reproducibility, patient noncooperation, and difficulty in deployment at the bedside are very large [15, 16]. It also limits the early detection and diagnosis of atelectasis. The lung ultrasound at the bedside has the advantages of portability, nondestructiveness, and reproducibility, which can timely determine the severity of the patient’s lung volume decline. Therefore, predicting the development of atelectasis, lung consolidation, pneumonia, pleural effusion, etc. is very important for the early diagnosis of the disease [17].

In recent years, with the progress of medical science and patients’ further attention and research on postoperative pulmonary complications, the lung air content of many patients has decreased to varying degrees after general anesthesia. There are various factors during the perioperative period, including the reduction of lung gas volume, which leads to the occurrence of atelectasis [2]. Before induction of general anesthesia, high oxygen concentration will make the lung foam disappear; the use of anesthetics and muscle relaxation can cause the patient to relax the muscles in the lungs, resulting in a decrease in the tension of the elastic contractive diaphragm on the lateral side of the chest wall; during the process of anesthesia, increased secretions such as alveoli small airway blockage lead to atelectasis. Under anesthesia, the ventilation and blood perfusion status of patients changes, and the ventilation volume in the middle and lower regions decreases, resulting in the condition of hypoventilation [18, 19].

Artificial bee colony algorithm is a common swarm intelligence optimization algorithm. Inspired by the distributed idea in big data, the distributed computing technology is introduced into the artificial bee colony algorithm, and a distributed artificial bee colony algorithm is proposed. For each new solution initialized in the solution space, the original ABC algorithm is used to carry out a new search for the number on each dimension [20]. This study was based on the characteristics of iterative optimization of intelligent group algorithm; that is, starting from the random solution, the optimal solution was found through iteration, and the quality of the solution was evaluated by fitness. Artificial bee colony (ABC) algorithm screened the image features of lung ultrasound to eliminate unnecessary eigenvalues, so as to reduce the time of SVM classification and training and reduce the complexity of the operation. In addition, the optimization algorithm was used to find out the optimal parameters needed for SVM classification and further improve the accuracy and efficiency of classification.

This research analyzed the difference between traditional ultrasonic image segmentation and swarm segmentation. Firstly, the image segmentation method which is often used in the field of medical image was studied and analyzed. At the same time, it also introduced a more favorable partial
image segmentation method and thresholding based segment-
mentation method. Multiple thresholding segmentation
methods could make up for the defect. By comparing the
threshold value and segmentation time of the image, it was
found that ABC algorithm was effective in medical image
segmentation. The advantages of the improved algorithm
were obtained through experiment 1. The influence of dif-
ferent anesthesia methods on postoperative pulmonary air
content of patients undergoing lower extremity orthopedic
surgery was observed by the algorithm combined with
pulmonary ultrasound. The pulmonary air content of the
control group and the algorithm group was mainly collected
at three time points: before surgery (T1) and 0.5 h (T2) and
20–30 h (T3) after surgery. Through analysis and compar-
ison, it was found that both the control group and the algo-

rithm group had different degrees of decreased lung gas
content at T2, the reduction degree of lung gas content in
both groups at T3 was relieved to varying degrees compared
with that at T2, and the reduction degree of lung gas content
in the algorithm group at T2 and T3 was significantly lower
than that in the control group. The results were statistically
significant, indicating that patients receiving conventional
ultrasound were more likely to have decreased lung gas
content after surgery than patients receiving artificial bee
colony algorithm combined with ultrasound anesthesia.
The results showed that the LUS score of the ABC algorithm
group was significantly higher than that of the general
anesthesia control group at T2, and the LUS score of the
ABC algorithm group was significantly higher than that of
the control group. The results showed that patients in the
algorithm group were more likely to have decreased lung gas
content after operation than those in the control group
under the same anesthesia. This result was also consistent
with other studies [20–24]. The shortcomings of this re-
search were as follows: The second experiment was only to
transform the medical image into gray image after image
segmentation; for the color of the medical image, the direct
segmentation method is still to be further studied. All the
medical image segmentation methods are single-target
problem, which only increases the number of values to be
segmented. In the future, multitarget medical image seg-
mentation can be considered. The programming of the algo-
rithm in this research still needs to be improved, and the
running speed of the system still needs to be optimized.

5. Conclusion

In this study, it was found that patients under general an-
esthesia were more likely to have reduced pulmonary gas
volume after surgery than patients under sclerosis combined
block anesthesia. The traditional ultrasound might result in a
decrease in lung volume. The LUS score of the traditional
sclerosis group and ABC sclerosis group was hugely higher
than the score of the traditional general anesthesia group and
ABC general anesthesia group at T2, with statistical sig-
ificance ($P<0.005$). At T3, the score of the traditional
sclerosis group rose greatly compared with the general
anesthesia group, and that of the ABC group was generally
higher than that of the traditional ultrasound group
($P<0.005$). When the threshold value was 4, the fitness value
of ABC algorithm was 2680.4461, and the fitness value of
control group was 1736.815. The difference between the two
groups was 943.6311 ($P<0.05$). The operation time of ABC
algorithm was 1.83, while that of control group was 1.05, and
the difference between the two groups was 0.78 ($P<0.05$).
Compared with traditional segmentation, the image seg-
mentation using the artificial bee colony algorithm had
clearer lung ultrasound images and more obvious lesions. In
the future, the researchers need to verify the performance of
the model in more cases and more types of diseases. In
addition, based on the statistics of various parameters of
patient information, the predictive effect of this method on
clinical diagnosis and prognosis needs further study.

Data Availability

The data used to support the findings of this study are
available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflicts of interest.

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