# A Novel Approach for Tracking Sperm from Human Semen Particles to Avoid Infertility

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**Abstract** Now a days, the infertility is a big problem for human being, especially for men. The mobility of the sperm does not depend on the number of sperm present in the semen. To avoid infertility, the detection rate of the multi moving sperms is to measured. There are different algorithms are utilized for detection of sperms in the human semen, but their detection rate is not up to the mark. This article proposed a method to track and detect the human sperm with high detection rate as compared to existing approaches. The sperm candidates are tracked using Kalman filters and proposed algorithms.

**Keywords** Sperm tracking · Detection rate · Background subtraction · Multi moving

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## 1 Introduction

In the emerging technological world, the infertility raises rapidly and destroys life of about 15% human couples [1]. Wenzhong et al. [2] and Menkveld et al. [3] describes the semen parameter for proper monitoring. There are different approaches are utilized to study about semen ability [4–7] to strengthen the human body. Now a days different methods are used to know the detection rate of sperms in the human semen to avoid infertility the proposed method is very efficient for tracking multiple sperm in human semen.

In the paper Sect. 2 describes the multiple sperm detection and tracking system: Sect. 3 describes the proposed algorithm. Section 4 describes experimental results and discussion. Section 5 describes conclusion part.

## 2 Multiple Sperm Detection and Tracking

Block diagram of our proposed multiple sperm detection and tracking system is shown in Fig. 1. Background subtraction module is given to camera.

To compute the evidence of sperm presence for each pixel on the image, segmented foreground is used. By locating storage element the detection of sperm is performed. After detection of sperm candidate, analytical models are computed for each of the candidates. To match sperms we have developed an efficient method. Each tracked sperm is represented by its analytical model and associated by Kalman filter. During matching process candidates are updated.

For background Subtraction, a pixel p represents color f(p), represented in rgl space (normalized red, normalized green and light intensity) Each pixel $P_i$ with models, is classified as:

$$\left| f_n(P_i) - m_k^c \right| > d_{th} V_k^c \tag{1}$$

where

$d_{th}$ decision boundary threshold
$V_k^c$ variance in channel c
$m_k^c$ k-th Gaussian mean vector in channel c

## 3 Proposed Algorithm

Step 1: Load microscopic video of human sperm.
Step 2: The line segment compute the support by Counting Sperms contained

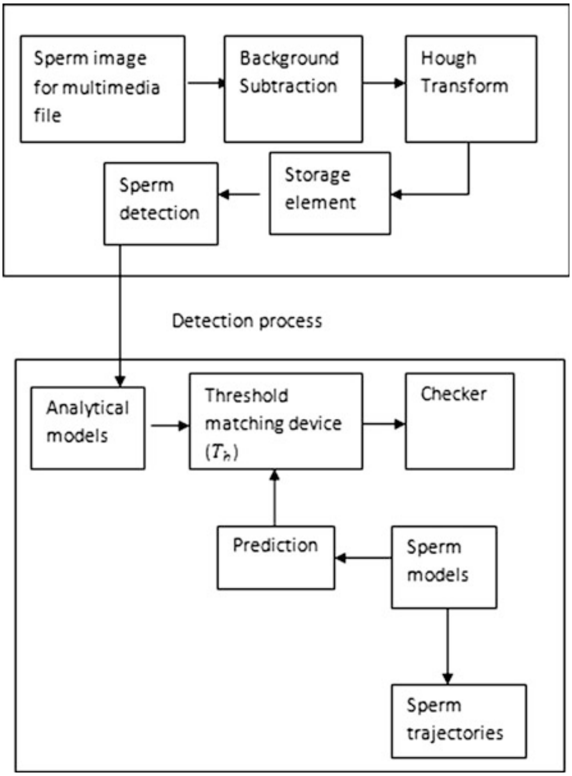


**Fig. 1** The proposed sperm tracking system

$(\mathrm{u} = P_i, \ldots P_n)$, $T_h^{(min)}$, $T_h^{(max)}$

Where $T_h^{(min)}$ *and* $T_h^{(max)}$ are the minimum and maximum thresholds.

Step 3: If $x_i$ is foreground then $f_i \leftarrow f_i + 1$
Else $f_i \leftarrow f_i - 1$
end if

Step 4: $f_j = i - T_h^{(max.)} P_i$
If $f_j > 0$ $T_h^{(max.)} \leftarrow [f_i - f_j]/P_i$
*else*

$$T_h^{(max.)} \leftarrow f_i/P_i$$

*end if*

Step 5: If $T_h \geq T_h^{(min)}$
Then $S(P_i) \leftarrow T_h$

**Table 1** Output for moving lyme disease tracking in rhesus macaques blood

| Microscopic video | Detection rate $(D_r)$ | Trial time in sec. |
|---|---|---|
| Human Sperm Microscopic Video | 98.12% | 0.011 |

Where, $S(P_i)$ = Supporting element for $T_h^{(min)}$ and $T_h^{(max)}$ for sperm dimension determination.
Else

$$S(P_i) \leftarrow 0$$

End if, until the value is converged.

## 4 Experimental Results and Discussion

This paper used a specific algorithm to detect multi moving sperms in human semen for proper diagnosis. The calculations of detection rate as indicated in Eq. 2.

$$D_r = \frac{T_p}{T_p + F_N} \quad (2)$$

where

$T_p$ detected pixel
$F_N$ undetected pixel

The Table 1 shows the output result of the proposed algorithm. From our knowledge the detection rate of proposed method is higher than the previously used approaches. The detection rate from microscopic view of semen specimen with sperms was satisfactory and for real time implementation which shown in Figs. 2, 3, 4, 5 and 6.

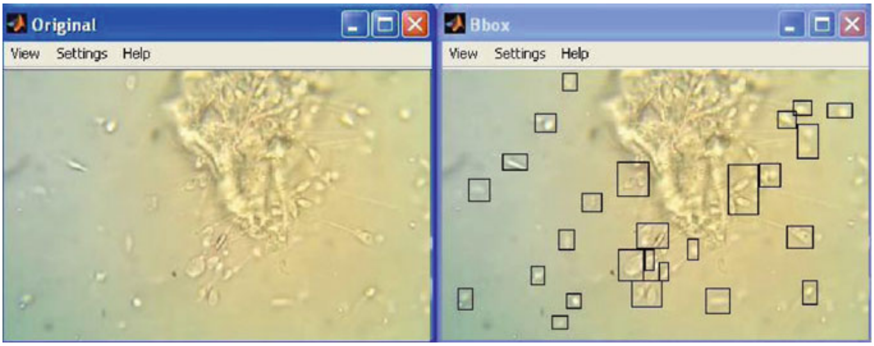


**Fig. 2** The 40X detected video


**Fig. 3** The 100X detected video


**Fig. 4** The 350X detected video


**Fig. 5** The 400X detected video

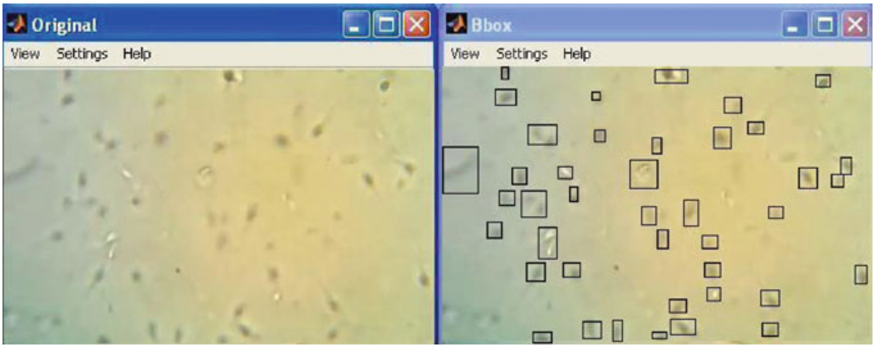


**Fig. 6** The 450X detected video

## 5 Conclusion

In this paper, a novel method for tracking sperm is proposed. The utilization of this method is able to track the sperms and detect with high detection rate. The detection rate is higher than the previously existing approaches. So this can be utilized for proper analysis of infertility in future.

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