Key Information Recognition Algorithm for Mobile Network Video Propagation based on Discrete GMM-HMM

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Abstract. In view of the problem that mobile network video transmission is prone to traffic congestion, the key information identification is carried out to improve the mobility of mobile network video transmission. A key information recognition method for mobile network video transmission is proposed based on Gaussian Mixture Model (GMM-HMM). The key information after feature separation is input into the neural network classifier to detect and process the key information of mobile network video transmission, and the key information identification of mobile network video transmission is completed. The simulation results show that the proposed method has strong anti-jamming ability, high probability of accurate recognition and good convergence of GMM-HMM Model, which improves the recognition efficiency.

Keywords: GMM-HMM, Mobile network video transmission, Key information, Identification

1. Introduction
With the continuous expansion of mobile network video transmission network scale, a large number of video transmission information transmission in the network, resulting in network congestion[1]. There are many factors that cause the key information of mobile network video transmission, such as network intrusion, network congestion and transmission channel distortion. In view of the above problems, this paper proposes a mobile network video transmission key information
recognition method based on GMM-HMM.

2. Mobile Network Video Propagation Traffic Transmission Model (GMM-HMM) and Time Series Analysis.

2.1. Transmission Model (GMM-HMM) of Video Propagation Traffic in Mobile Network
In order to accurately identify the key information of mobile network video transmission, firstly, read Slice data, the anomalous feature analysis in the storage pool of traffic is carried out, and the multipath channel Model of video transmission traffic in mobile network is constructed as follows:

\[ f_y(y; \lambda_0) = \frac{2y}{\lambda_0^2} e^{-\frac{y^2}{\lambda_0^2}} \]  

In the above formula, \( \lambda_0 \) represents the sampling amplitude of video traffic statistics in mobile network, \( \theta \) represents the basic offset phase of traffic sequence sampling, and \( r(t) \) represents the sampling amplitude [1]. the \( K_v(z) \) function denotes that the traffic transport statistical characteristic of mobile network video transmission satisfies the Weibull distribution with parameters \( (\alpha, \beta) \). According to the test statistics and threshold relation, \( \alpha_s \geq 0, \sum_{i=1}^{K} \alpha_i = 1 \), also:

\[ F_s(x; \alpha, \lambda) = 1 - \frac{1}{2^{\alpha - 1} \Gamma(\alpha)} \frac{4 \sqrt{\lambda \Gamma(\alpha)}}{\gamma V^{\alpha - 1}} \int_{0}^{\infty} K_{\alpha - 1}(w) dw \]  

2.2. Nonlinear Time Series Analysis of Key Information in Mobile Network Video Propagation
The nonlinear time series analysis method is used to analyze and identify the key information of video propagation in mobile networks. Let \( Z = (U, V) \) be a binary distributed geometry consisting of a set of normal traffic \( U \) and a set of key information statistics \( V \). The critical information \( X \) of network transmission accords with \( \alpha \)-stable distribution, which is denoted as \( X \sim S_{\alpha}(\sigma, \beta, \mu) \), \( \beta \) to represent the maximum recognition threshold. \( K_{\alpha}(w) \) is the nonlinear time series distribution function of critical information for video transmission in mobile networks[2]. When \( V \) is a continuous variable, the statistical characteristic function of the key information of video transmission in mobile network is obtained as:
\[ \Phi(\omega) = E[e^{j\omega X}] = \begin{cases} \exp\{j\mu\omega - j\beta \text{sgn}(\omega) \tan(\frac{\pi \alpha}{2})\}, & \alpha \neq 1 \\ \exp\{j\mu\omega - j\beta \text{sgn}(\omega) \frac{2}{\pi} \ln|\omega|\}, & \alpha = 1 \end{cases} \] (3)

\[ L'_{i+1} = (1 - \lambda) \sum_{n=0}^\infty S_{i+n}(n+1)b \] (4)

In the formula, \( \Omega \) is the second kind of modified Bessel function (also called Basset function), \( \alpha \) denotes the characteristic parameter of local stationarity of the key information of video transmission in mobile network, and \( \lambda \) is the scale factor [2]. According to the local stationary analysis and nonlinear feature evaluation of the key information in mobile network video transmission, the key information identification is carried out.

3. Improved Implementation of Key Information Recognition Algorithm

3.1. GMM-HMM Algorithm

On the basis of feature extraction of key information in mobile network video transmission using video bit sequence stream recombination method, an improved algorithm for mobile network video transmission key information recognition algorithm is designed. In this paper, a mobile network video transmission key information recognition method based on GMM-HMM is proposed [3-5]. Using GMM-HMM method, the key information feature extraction is carried out, and the Itakura distance of the distribution of key information features is obtained as follows:

\[ d_i(s_1, s_2) = \frac{1}{2} \left[ d_i(s_1, s_2) + d_i(s_2, s_1) \right] \] (5)

If \( x_1(t) \) and \( x_2(t) \) represent the feature components of two sets of the key information transmitted by the network, the eigen-decomposition formula is obtained.

\[ A_2(z) = \sum_{k=0}^{p_2} a_{2k} z^{-k}, \quad a_{20} = 1 \] (6)

According to the above, we can use the piecewise replica correlation recognition method under the GMM-HMM Model to extract and recognize the special features of the key information in the mobile network video transmission [6]. Finally, the key information identification of mobile network video transmission is completed.

4. Simulation Experiment and Performance Analysis

In order to test the performance of this algorithm in identifying the abnormal features of key information in mobile network video propagation, simulation experiments are carried out. The method of this paper is used to identify the key information of mobile
network video propagation with shorter delay, which improves the timeliness and convergence of mobile network video transmission critical information recognition for the total mobile network video propagation are shown in Figure 1.

The simulation results show that the proposed method has good accuracy and strong anti-interference ability [7-9].

5. Conclusions
In this paper, a key information recognition method for mobile network video transmission is proposed based on GMM-HMM. The proposed method has strong anti-jamming ability, it has high probability of accurate recognition and good convergence of GMM-HMM Model, which improves the recognition efficiency. This method has good application value in the optimization control of mobile network video propagation [10].

![Figure 1 Delay testing of key information identification in mobile network video propagation](image1)

![Figure 2 Accuracy test of key information identification in mobile network video transmission](image2)
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