3. Proposed System Process Flow

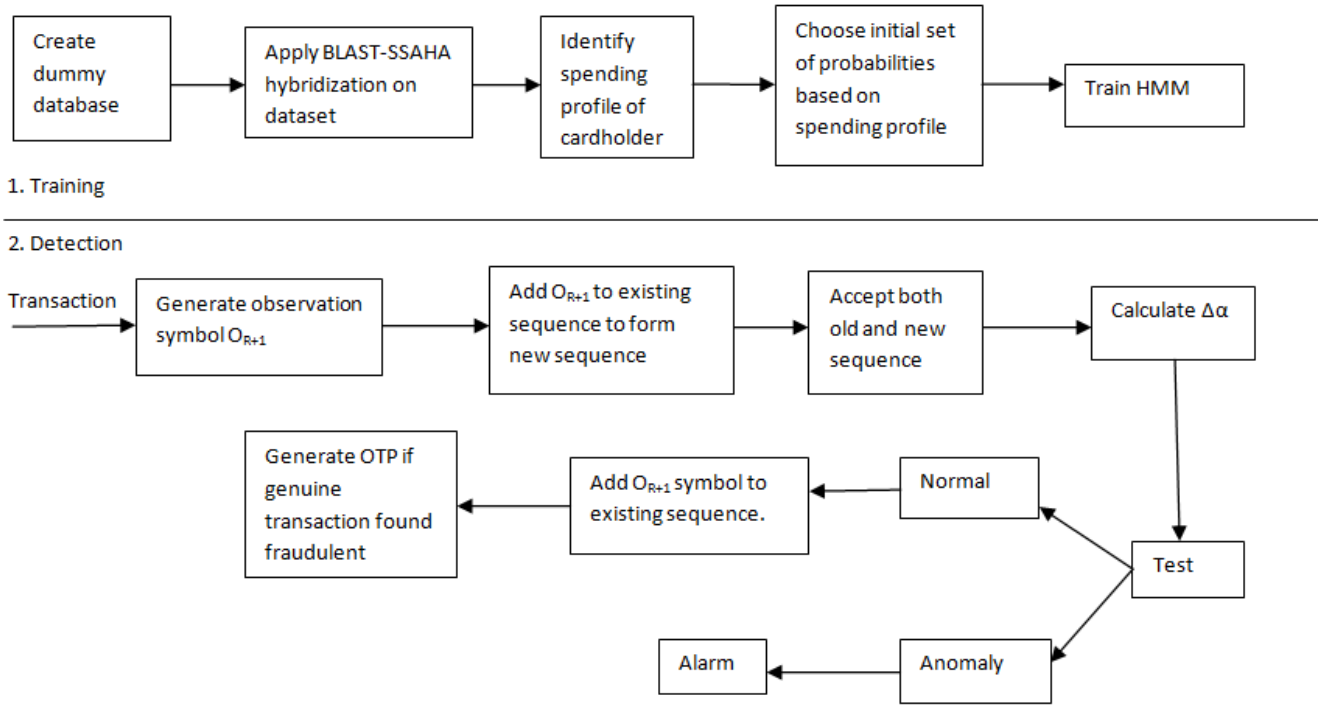

Figure 2: Fraud detection system process flow

The Fig2 describes the fraud detection system flow. The fraud detection system contains two phase named training phase and detection phase.

C. Training Phase

Dummy database is created because of privacy of banks. Dummy database consists of valid database and fraudulent database. The BLAST-SSAHA Hybridization is applied on a both the valid and fraudulent database for the optimization. The HSPs, concept of BLAST algorithm are generated as two pairs. The first pair contains credit card number, income and account balance while second pair contains credit card number, income and transaction. k-tuple table , concept of SSAHA is created to detect whether the generated HSPs is repeated or not in the database. The k-tuple table contains tuple weight and sequence index. Two k-tuples are called overlapping if they share same amount of information between them. Every distinct k-tuple is assigned an integer value which is called "tuple weight". Sequence index is used to represent i_{th} sequence of the data in the database. If the generated HSPs are repeated in the database then sequence index will hold the value more than one and if it is not repeated then sequence index represent value equals to 1. Then identify the spending profile of cardholder which contain transaction amount information and choose initial set of probabilities on spending profile of cardholder and trained HMM on the set of sequence.

D. Detection Phase

After the HMM parameters are learned, we have taken the symbols from a cardholder's training data and form an initial sequence of symbols. Let O_1 ,O_2 ,….O_R be one such sequence of length R. This recorded sequence is formed from the cardholder's transactions up to time t. We input this sequence to the HMM and compute the probability of acceptance by the HMM. Let the probability be α1, which can be written as:

$$\alpha 1 = P(O_1, O_2, \ldots O_R \mid \lambda)$$

Let O_{R+1} be the symbol generated by a new transaction at time t+1. To form another sequence of length R, drop O_1 and append O_{R+1} in that sequence , generating $O_2,O_3,\ldots O_R,O_{R+1}$ as the new sequence. Input this new sequence to HMM and calculate the probability of acceptance. Let the new probability be α2.

$$\alpha 2 = P(O_2, O_3, \ldots O_R, O_{R+1} \mid \lambda)$$

$$\Delta\alpha = \alpha 1 - \alpha 2$$

If $\Delta\alpha > 0$ it means that the new sequence is accepted by the HMM with low probability, and it could be a fraud.

If the system detects genuine transaction as a fraud then one time password will be sent to the genuine cardholder in order to process genuine transaction. If the fraudsters stole the credit card number and process the transaction by entering transaction amount at the same time the one time password will be sent to the genuine cardholder and fraudster will not be able to perform transaction, system will generate the alarm and transaction process will be declined. So, the genuine transaction will not be rejected during its transaction time.

4. Experimental Results and Analysis

In this section we show the performance of system, experimental results and analysis on various transaction amounts. Table 1 below shows the list of transaction with

different transaction amount and different categories of purchasing type.

Table 1: List of all Transaction

Transaction No.	Category	Amount in Rs
1st	1	25
2nd	3	560
3rd	2	50
4th	4	600
5th	2	450
6th	2	300
7th	1	700
8th	3	70
9th	3	400
10th	1	335
11th	4	426
12th	2	220
13th	1	315
14th	3	360
15th	4	100

According to this table we propose:

Figure 3: Transaction amount of each category.

Figure 4 shows the mean distribution of fraud transaction where the probability of fraud transaction is compared with the genuine transaction.

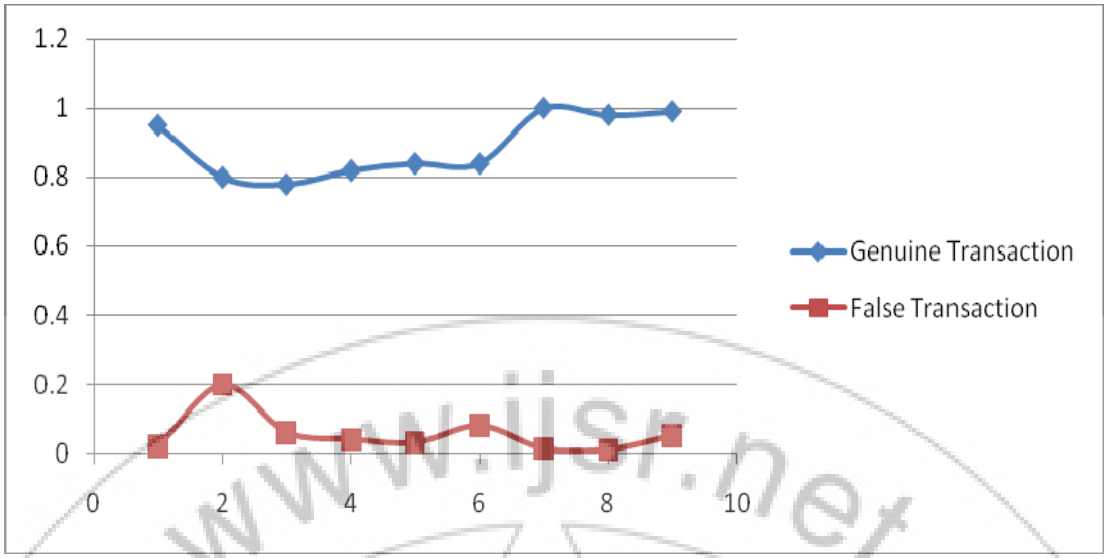

Figure 4: Mean distribution of Fraud Transaction

From the above figure it is noted that the when the probability of genuine transaction is going down correspondingly the probability of fraudulent transaction is going to increase and vice-versa. It helps to find out false alarm for the detection of fraud transaction.

Table 2: Experimental results of different range of transaction

Transaction No.	Transaction Amount(Rs.)	Transaction Found Genuine(G)/Fraudulent (F)	OTP Entered	Transaction Processed
1	250	G	-	YES
2	300	G	-	YES
3	450	G	-	YES
4	600	G	-	YES
5	700	G	-	YES
6	4000	F	YES	YES
7	5530	F	NO	NO
8	4300	F	YES	YES
9	345	G	-	YES
10	175	G	-	YES
11	2220	F	NO	NO
12	3350	F	YES	YES

Table 2 shows the performance of the system. The transaction amount called as observation symbol of HMM is taken into consideration. If the transaction amount is within the range of genuine cardholder then system detects the transaction as genuine transaction and allows processing the transaction of genuine cardholder. But if the genuine cardholder process transaction beyond the transaction amount range then system detects genuine transaction as a fraudulent transaction and at the same time system sends one time password (OTP) to genuine cardholder. If the cardholder enters the OTP which is generated by bank server correctly, the system continues his transaction as shown in Table 2 otherwise declined the transaction. On the other hand if there is a fraudster processing transaction of genuine cardholder beyond the range, again system sends OTP to genuine cardholder. Fraudster will not be able to see that OTP. If he tries to enter any random OTP then system produce message of declined transaction.

According to this we propose:

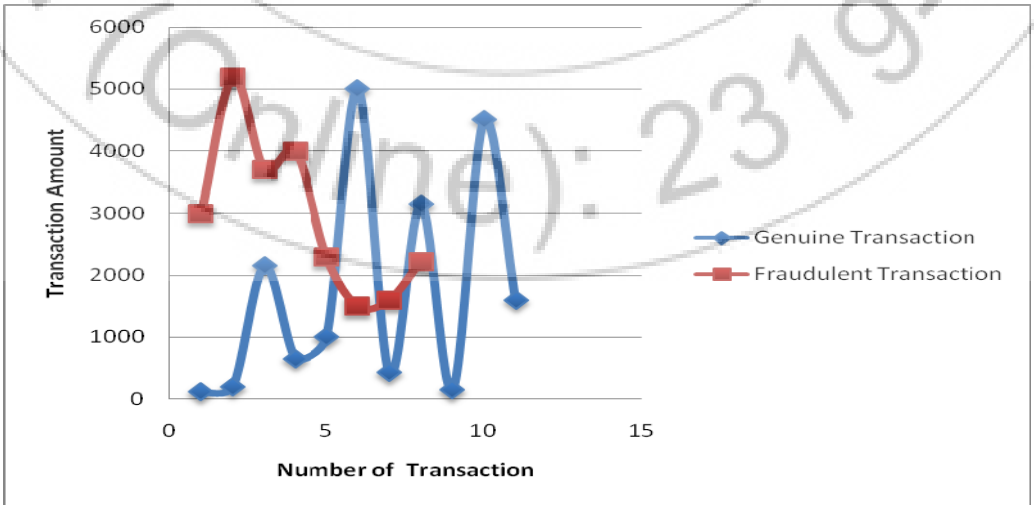

Figure 5: Comparison of genuine and fraudulent transaction with different ranges of transaction amount

5. Future Scope

In my research transaction amount was considered as an observation symbol. In future we could take other parameters to make system strong and reliable. A different algorithm for checking fraud detection making system more and more accurate and reliable could be designed and implemented. Instead of HMM and BLAST-SSAHA Hybridization algorithm we could use another algorithm.

6. Conclusion

The efficient internet banking fraud detection system is an utmost requirement for any card issuing bank. We have proposed algorithm named BLAST-SSAHA Hybridization for optimization of dataset and HMM model for internet banking fraud detection. We have used transaction amount as the observation symbol. We have suggested a method for finding spending profile of cardholders as well as application of this knowledge in deciding the values of observation symbol and initial estimate of model parameters. We have also been explained how the HMM can detect whether the incoming transaction is a case of fraud or not. It also removes high false alarm rate generated by the system. We have generated One Time Password so that genuine transaction should not be rejected during transaction process.

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Author Profile

Ms. Avanti Vaidya is a P.G. Scholar in Computer Science and Engineering from B. D. College of Engineering, Sewagram, MH, and India. She has received her BE degree from B. D. College of Engineering, Nagpur University, India in 2011. She has published three papers in International journal and presented two papers in International conference and one paper in national conference. Her research interest is Data Mining and warehousing, data security.

Prof. S. W. Mohod is working as an Assistant Professor (Sr.Gr.) in P.G. Department of Computer Science and Engineering at B. D. College of Engineering, Sevagram , MH, India. He did his B.E in 1995 and ME in 2006 in Computer Science and Engineering from Amravati university, Amravati. He has published many research papers in international journal and conference and national journal and confereces. He is a life member of ISTE and IE .His area of interest is data mining and networking.#