CHAPTER 7

RESULTS AND DISCUSSION

In this section provides the performance comparisons of classifiers with triple feature sets. The results of classifiers are measured by the proposed feature selection methods (KPCA+ FMBOA, and KPCA+ OBEFS). Results are measured by metrics like f-measure, accuracy, error, and MCC.

The Constraints defined for the proposed work are kernel selection and the number of the principal components, Search Space Bounds and Number of Optimization Iterations, Search Space Bounds and population size and generations, variables are kernel type and its associated hyper parameters, population size, mutation rates, crossover rates, Binary variables representing the selection status of each feature.

In this paper, a comprehensive comparison was undertaken between the most effective methodologies and earlier investigations pertaining to the prediction of Parkinson's disease. The evaluation encompassed the utilization of the same dataset as well as additional datasets, as illustrated in Table 7.1. The findings of the comparative analysis revealed that the optimal approach, involving FCBi-LSTM CNN classifier coupled with a wrapper-based feature selection method utilizing CNN as the base classifier and employing dimensionality reduction and optimization-based feature selection methods, demonstrated results that were both comparable and superior to those of previous studies.

TABLE 7.1. Classifiers Results Comparison with Triple Feature Sets

TQWT+MFCC+Wavelet (%)			
CLASSIFIER	**F-measure**	**Accuracy**	**MCC**
KPCA+ mRMR- FCLSTM-CNN	93.0257	92.1457	66.3669
KPCA+ FMBOA- FCBi-LSTM	95.3965	94.3965	71.3513
KPCA+ OBEFS- FCLSTM-CNN	94.2258	93.0470	67.6669
KPCA+ OBEFS- FCBi-LSTM	98.3100	96.6381	74.3000

KPCA+ OBEFS- EDL	99.4490	97.7710	75.4320
TQWT+MFCC+Concat(%)			
CLASSIFIER	**F-measure**	**Accuracy**	**MCC**
KPCA+ mRMR- FCLSTM-CNN	90.3252	92.1854	66.4060
KPCA+ FMBOA- FCBi-LSTM	93.3252	95.7455	69.4017
KPCA+ OBEFS- FCLSTM-CNN	91.5250	93.0854	67.7060
KPCA+ OBEFS- FCBi-LSTM	96.5900	98.0244	72.3000
KPCA+ OBEFS- EDL	97.7220	99.1560	73.4120
TQWT+ Wavelet + Concat (%)			
CLASSIFIER	**F-measure**	**Accuracy**	**MCC**
KPCA+ mRMR- FCLSTM-CNN	92.2252	92.2252	64.1457
KPCA+ FMBOA- FCBi-LSTM	94.4252	94.2252	65.9483
KPCA+ OBEFS- FCLSTM-CNN	93.4200	93.1261	65.4457
KPCA+ OBEFS- FCBi-LSTM	97.5200	97.3457	70.3000
KPCA+ OBEFS- EDL	98.6520	98.3780	71.0130
MFCC + Wavelet + Concat (%)			
CLASSIFIER	**F-measure**	**Accuracy**	**MCC**
KPCA+ mRMR- FCLSTM-CNN	90.4729	94.2557	65.9960
KPCA+ FMBOA- FCBi-LSTM	95.4530	96.2865	67.9917
KPCA+ OBEFS- FCLSTM-CNN	91.6921	95.1557	67.2960
KPCA+ OBEFS- FCBi-LSTM	98.5010	98.7720	71.4000
KPCA+ OBEFS- EDL	99.6330	99.9030	72.4310

Triple feature sets are employed for new experiments with the proposed classifiers. The results of the classifications with the triplet feature extractions are expressed at Table 7.1.

The first proposed classifier model KPCA, mrMR - FCLSTM-CNN when used in combination with TQWT+MFCC+Wavelet (%) feature extraction the F-Measure is 93.0257, accuracy is 92.1457 , MCC is 66.3669, when used in combination with TQWT+ MFCC+ Concat (%)feature extraction the F-Measure is 90.3252, accuracy is 92.1854, MCC is 66.406 ,

with TQWT+ Wavelet + Concat (%) feature extraction the F-Measure is 92.2252, accuracy is 92.2252, MCC is 64.1457 and finally when used in combination with MFCC + Wavelet + Concat (%)feature extraction the F-Measure is 90.4729, accuracy is 94.2557, MCC is 65.996.

The second proposed classifier model KPCA, FMBOA- FCBi-LSTM when used in combination with TQWT+MFCC+Wavelet (%) feature extraction the F-Measure is 95.3965, accuracy is 94.3965, MCC is 71.3513, when used in combination with TQWT+ MFCC+ Concat (%)feature extraction the F-Measure is 93.3252, accuracy is 95.7455, MCC is 69.4017, with TQWT+ Wavelet + Concat (%) feature extraction the F-Measure is 94.4252, accuracy is 94.2252, MCC is 65.9483 and finally when used in combination with MFCC + Wavelet + Concat (%)feature extraction the F-Measure is 95.4530, accuracy is 96.2865, MCC is 67.9917.

The third proposed classifier model KPCA, OBEFS- FCLSTM-CNN when used in combination with TQWT+MFCC+Wavelet (%) feature extraction the F-Measure is 94.2258, accuracy is 93.0470, MCC is 67.6669, when used in combination with TQWT+ MFCC+ Concat (%)feature extraction the F-Measure is 91.5250, accuracy is 93.0854, MCC is 67.706, with TQWT+ Wavelet + Concat (%) feature extraction the F-Measure is 93.4200, accuracy is 93.1261, MCC is 65.4457 and finally when used in combination with MFCC + Wavelet + Concat (%)feature extraction the F-Measure is 91.6921, accuracy is 95.1557, MCC is 67.296.

fourth proposed classifier model KPCA, OBEFS- FCBi-LSTM when used in combination with TQWT+MFCC+Wavelet (%) feature extraction the F-Measure is 98.3100, accuracy is 96.6381, MCC is 74.300, when used in combination with TQWT+ MFCC+ Concat (%)feature extraction the F-Measure is 96.5900, accuracy is 98.0244, MCC is 72.300, with TQWT+ Wavelet + Concat (%) feature extraction the F-Measure is 97.5200, accuracy is 97.3457, MCC 70.300 and finally when used in combination with MFCC + Wavelet + Concat (%)feature extraction the F-Measure is 98.5010, accuracy is 98.7720, MCC is 71.400.

The fifth proposed classifier model KPCA, OBEFS- EDL when used in combination with TQWT+MFCC+Wavelet (%) feature extraction the F-Measure is 99.4490, accuracy is 97.7710, MCC is 75.4320, when used in combination with TQWT+ MFCC+ Concat (%)feature extraction the F-Measure is 97.7220, accuracy is 99.1560, MCC is 73.4120, with

TQWT+ Wavelet + Concat (%) feature extraction the F-Measure is 98.6520, accuracy is 98.3780, MCC 71.0130 and finally when used in combination with MFCC + Wavelet + Concat (%)feature extraction the F-Measure is 99.6330, accuracy is 99.9030, MCC is 72.4310.

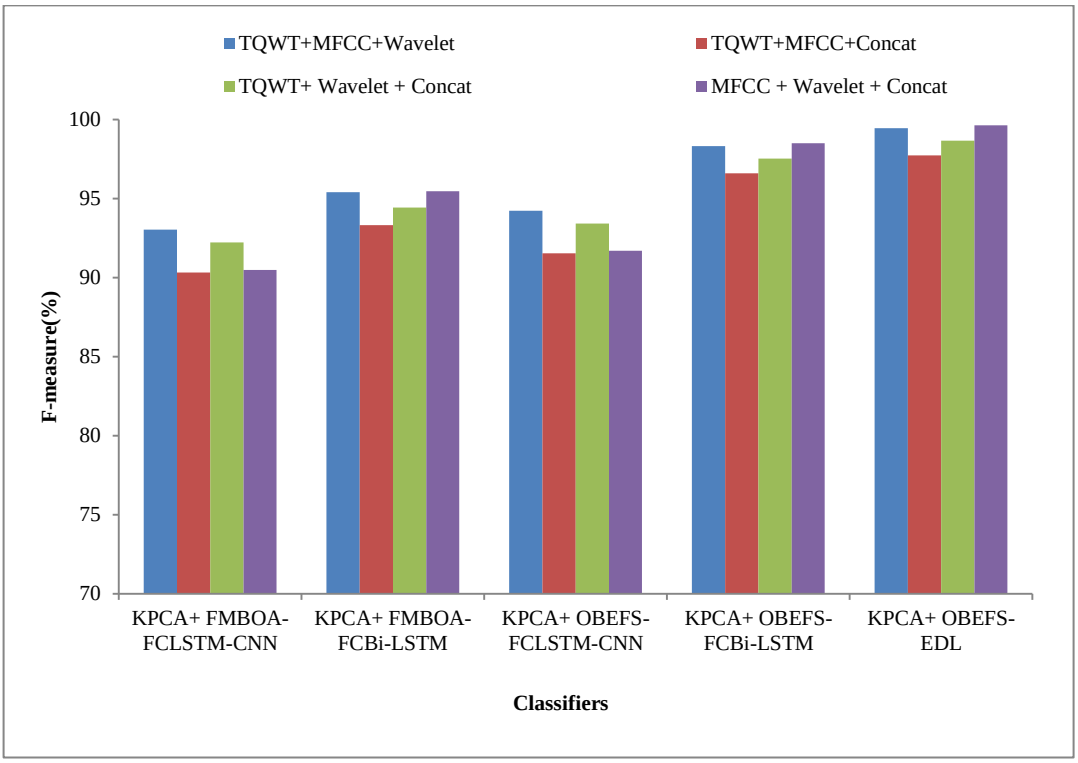

Figure 7.1. F-Measure Comparisons and. Classifiers (Triplet Feature Sets)

Figure 7.1 shows the f-measure findings plotted on the y-axis and the triple feature level of classifiers displayed along the x-axis. The final feature level combination with proposed classifier yields higher results of 99.9030%, other techniques like FCLSTM-CNN(KPCA+FMBOA), FCLSTM-CNN(KPCA+OBEFS), FCBi-LSTM(KPCA+FMBOA), and FCBi-LSTM(KPCA+OBEFS) attains lower f-measure of 90.4729%, 91.6921%, 95.453 %, and 98.501% correspondingly.

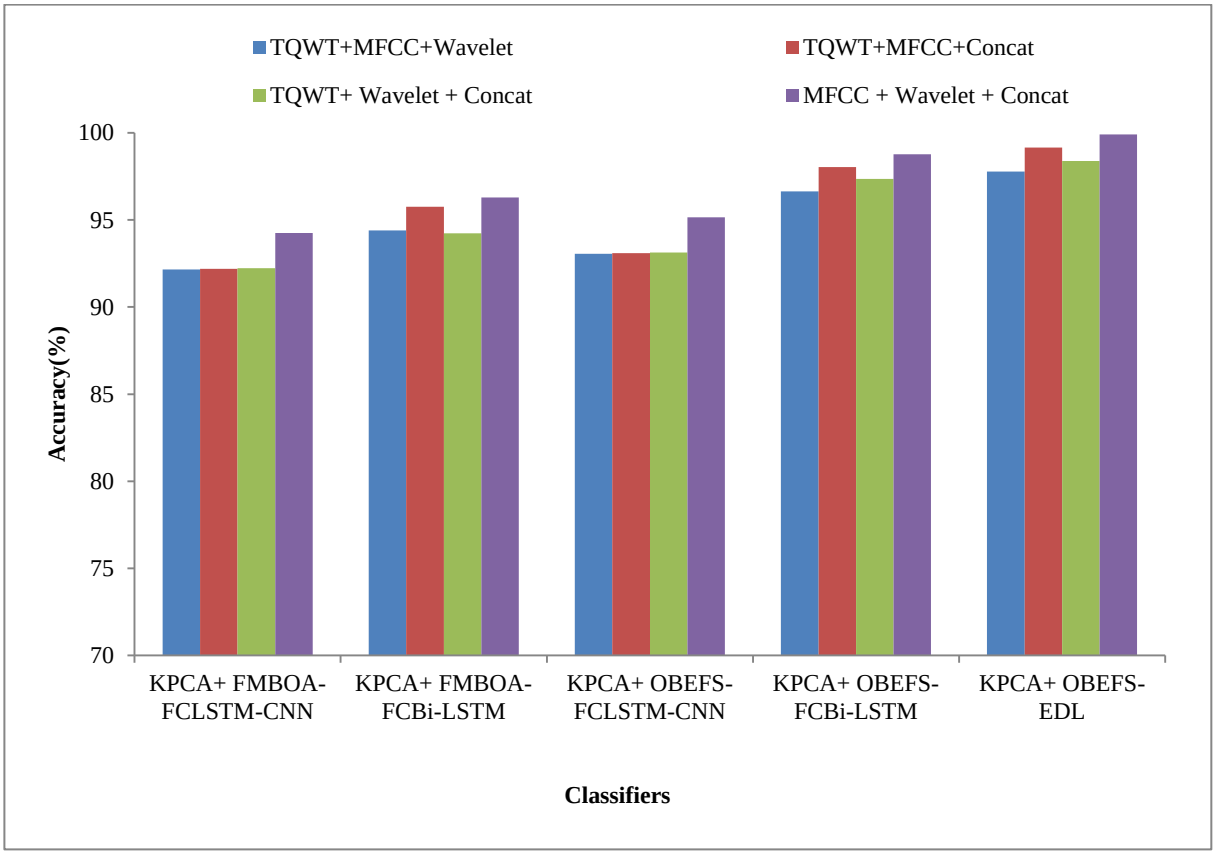

Figure 7.2. Accuracy Comparison and Classifiers (Triple Feature Sets)

Figure 7.2 depicts accuracy results with a triple feature-level of classifiers plotted along the x-axis, and the results are plotted along the y-axis results. Final feature set with proposed classifier yields higher results of 99.9030%, other techniques like FCLSTM-CNN(KPCA+FMBOA), FCLSTM-CNN(KPCA+OBEFS), FCBi-LSTM(KPCA+FMBOA), and FCBi-LSTM(KPCA+OBEFS) attain slower accuracy of 94.2557%, 95.1557%, 96.2865%, and 98.772% correspondingly.

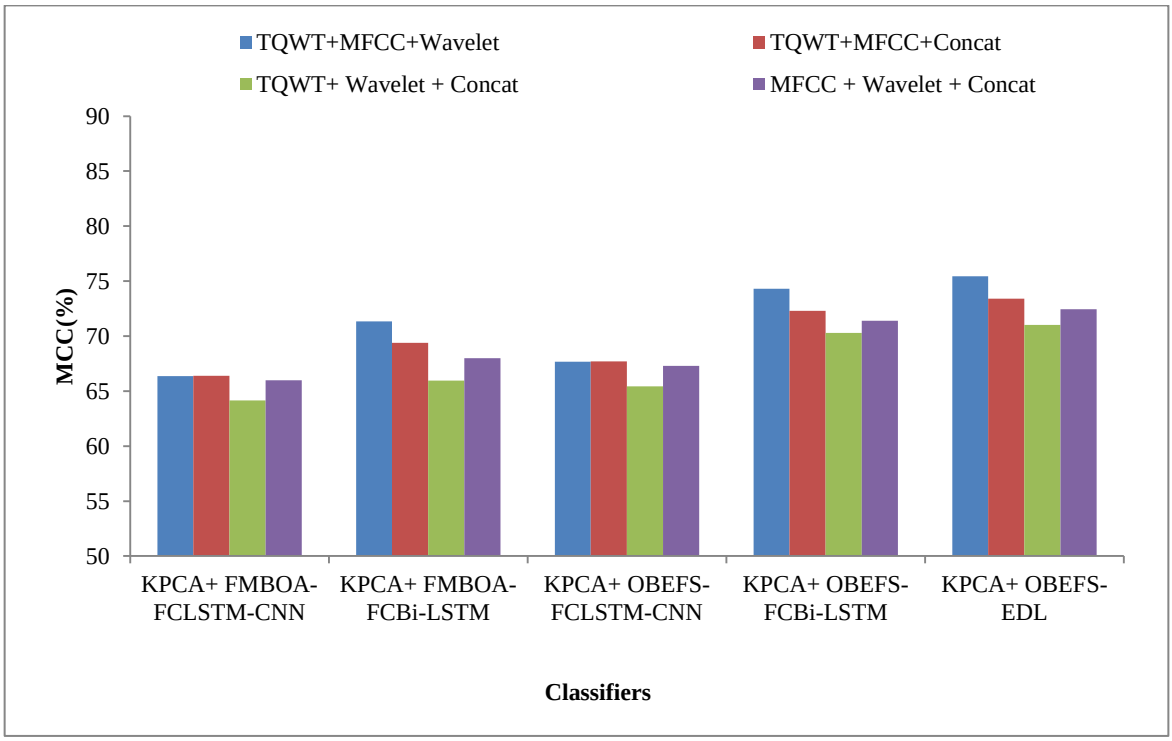

Figure 7.3. MCC Comparison and Classifiers (Triple Feature Sets)

Figure 7.3 depicts MCC results with a triple feature-level of classifiers plotted along the x-axis, and the results are plotted along the y-axis results. Proposed classifier by final feature set yields higher results of 72.431%, techniques like FCLSTM-CNN(KPCA+FMBOA), FCLSTM-CNN(KPCA+OBEFS), FCBi-LSTM(KPCA+FMBOA), and FCBi-LSTM(KPCA+OBEFS) attains lower MCC of 65.996%, 67.296%, 67.9917%, and 71.400% correspondingly.