Chapter - 5
CHAPTER - 5
RESULTS AND DISCUSSION

5.1 RESULTS

The experimentation outcome of fuzzy based classifiers is discussed in this chapter. The research system is implemented by MATLAB 2014 and the experimental part is carried out with i5 processor with 3GB RAM. In this chapter the performance metrics has been gauged and the outcomes of the diverse classification techniques such as IACOSAF, IACOF, ACOF, CSF, Fuzzy K means (FKM) and Fuzzy have been analyzed.

5.2 MATLAB DESCRIPTION

Matrix Laboratory (MATLAB) is known as a multi-paradigm numerical computing environment and also is a fourth-generation programming language. A proprietary programming language established by Math Works, it lets matrix manipulations, implementation of algorithms, mapping of functions and data, formation of user interfaces, and interfacing with programs written in other languages. The MATLAB application is formed by the MATLAB scripting language. General usage of the MATLAB application includes the Command Window as an interactive mathematical shell or performing text files comprising MATLAB code.

Variables: Variables are defined by the assignment operator, =. MATLAB is a poorly typed programming language as types are implicitly converted. It is an inferred typed language since variables could be assigned devoid of declaring their type, and excluded if they are
to be considered as symbolic objects. There are chances that their type could vary. Values could come from constants, from calculations and includes values of other variables or from the output of a function.

**Structures**: MATLAB contains structure data types. As all variables in MATLAB are arrays, a more suitable name is "structure array". Here every element of the array contains the identical field names. Furthermore, MATLAB aids in the use of dynamic field names. Inopportunely, MATLAB JIT does not aid MATLAB structures; so, merely a simple bundling of numerous variables into a structure would come at a price.

**Functions**: The rules for creating a MATLAB function are as follows, the name of the file must match the name of the first function in the file. Function names may start with an alphabetic character, and could include letters, numbers, or underscores. Functions are case sensitive.

**Function Handles**: MATLAB aids elements of lambda calculus by presenting function handles, or function references that are implemented either in .m files or anonymous/nested functions.

**Classes and Object-Oriented Programming**: MATLAB aids object-oriented programming that includes classes, virtual dispatch, inheritance, packages, pass-by-value semantics, and pass-by-reference semantics. Nevertheless, the syntax and calling conventions are meaningfully is similar from other languages.

**Graphics and Graphical user Interface Programming**: MATLAB helps in creating applications by using Graphical User Interface (GUI) features. MATLAB comprises GUI Development Environment (GUIDE)
for graphically designing GUIs. It furthermore contains strongly incorporated graph-plotting features.

**Interfacing with other Languages:** Libraries written in Perl, Java, ActiveX or .NET could be unswervingly called from MATLAB, and various MATLAB libraries are developed as wrappers around Java or ActiveX libraries. Calling MATLAB from Java is very difficult, nevertheless could be accomplished with a MATLAB toolbox that is sold distinctly by Math Works, or by utilizing an undocumented technique known as Java-to-MATLAB Interface (JMI).

### 5.3 PERFORMANCE COMPARISON

This section evaluates the performance comparison of different classifiers. Table 5.1 shows sensitivity analysis results of different classification methods such as IACOSAF, IACOF, ACOF, CSF, FKM and Fuzzy classifier. From the results it concludes that the ACO based fuzzy classifiers produces sensitivity results of 93.33% (IACOSAF), 87.62% (IACOF), and 82.1429% (ACOF) methods for CTG respectively.

<table>
<thead>
<tr>
<th>Datasets</th>
<th>Sensitivity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fuzzy</td>
</tr>
<tr>
<td>CTG</td>
<td>60</td>
</tr>
<tr>
<td>Abalone</td>
<td>57.1429</td>
</tr>
<tr>
<td>Iris</td>
<td>48</td>
</tr>
<tr>
<td>CHD</td>
<td>69.0476</td>
</tr>
</tbody>
</table>

Table - 5.1

Sensitivity Metrics Vs. classifiers
Figure 5.1(a) shows sensitivity analysis results of different classification methods such as ACOF, CSF, FKM and Fuzzy classifier. Figure 5.1(a) shows sensitivity results of 82.1429% for ACOF, 76.1905% for CSF, 73.8095% for FKM and 69.0476% for fuzzy classifier in CHD dataset. The proposed ACOF classifier produces higher sensitivity results of 82.1429% which is 5.9254%, 8.3334% and 13.0953% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed ACOF classifier produces higher sensitivity results when compared to all other methods.
The proposed ACOF produces higher sensitivity results of 76% which is 4%, 12% and 28% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed ACOF classifier produces higher sensitivity results of 74.2857% which is 5.7143%, 10% and 17.1428% is higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed ACOF classifier produces higher sensitivity results of 76% which is 6%, 12% and 16% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed ACOF classifier produces higher sensitivity results when compared to all other methods.

**Figure - 5.1(b)**

Sensitivity analysis Vs. classifiers (IACOF and Existing classifiers)
Figure 5.1(b) shows sensitivity analysis results of different classification methods such as IACOF, CSF, FKM and Fuzzy classifier. Figure 5.1(b) shows sensitivity results of 87.62% for IACOF, 76.1905% for CSF, 73.8095% for FKM and 69.0476% for fuzzy classifier in CHD dataset. The proposed IACOF classifier produces higher sensitivity results of 87.62% which is 11.4295%, 13.8105% and 18.5724% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed IACOF classifier produces higher sensitivity results when compared to all other methods. The proposed IACOF classifier produces higher sensitivity results of 80% which is 8%, 16% and 32% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed IACOF classifier produces higher sensitivity results of 80% which is 11.4286%, 15.7143% and 22.8571% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOF classifier produces higher sensitivity results of 84% which is 14%, 20% and 24% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOF based classifier produces higher sensitivity results when compared to all other methods.

Figure 5.1(c) shows sensitivity analysis results of different classification methods such as IACOSAF, CSF, FKM and Fuzzy classifier. Figure 5.1(c) shows sensitivity results of 93.3333% for IACOSAF, 76.1905% for CSF, 73.8095% for FKM and 76% for fuzzy classifier in CHD dataset. The proposed IACOSAF classifier produces higher sensitivity results of 93.3333% which is 17.1428%, 19.5238% and
24.2857% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed IACOSAF classifier produces higher sensitivity results when compared to all other methods. higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure_5.1c.png}
\caption{Sensitivity analysis Vs. classifiers (IACOSAF and Existing classifiers)}
\end{figure}

The proposed IACOSAF classifier produces higher sensitivity results of 88% which is 16%, 24% and 40%. The proposed IACOSAF classifier produces higher sensitivity results of 85.7143% which is 16%, 24% and 40% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOSAF classifier produces higher sensitivity results of 88% which is 18%, 24% and 28%
higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOSAF classifier produces higher sensitivity results when compared to all other methods.

**Table - 5.2**

**Specificity metrics Vs. classifiers**

<table>
<thead>
<tr>
<th>Datasets</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fuzzy</td>
</tr>
<tr>
<td>CTG</td>
<td>37.50</td>
</tr>
<tr>
<td>Abalone</td>
<td>58.18</td>
</tr>
<tr>
<td>Iris</td>
<td>56.00</td>
</tr>
<tr>
<td>CHD</td>
<td>66.66</td>
</tr>
</tbody>
</table>

**Figure - 5.2(a)**

Specificity analysis vs. classifiers (ACOF and Existing classifiers)
Figure 5.2(a) shows specificity analysis results of different classification methods such as ACOF, CSF, FKM and Fuzzy classifier. Figure 5.2(a) shows specificity results of 88.09% for ACOF, 78.57% for CSF, 80.95% for FKM and 66.66% for fuzzy classifier in CHD dataset.

The proposed ACOF classifier produces higher specificity results of 88.09% which is 9.52%, 7.14% and 21.43% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed ACOF classifier produces higher specificity results when compared to all other methods. The proposed ACOF produces higher specificity results of 68% which is 4%, 8% and 12% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed ACOF classifier produces higher specificity results of 66.36% which is 1.82%, 4.55% and 8.18% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed ACOF classifier produces higher specificity results of 67.50% which is 10%, 20% and 30% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed ACOF classifier produces higher specificity results when compared to all other methods.

Figure 5.2(b) shows specificity analysis results of different classification methods such as IACOF, CSF, FKM and Fuzzy classifier. Figure 5.2(b) shows specificity results of 90% for IACOF, 78.57% for CSF, 80.95% for FKM and 66.66% for fuzzy classifier in CHD dataset.

The proposed IACOF classifier produces higher specificity results of 90% which is 11.43%, 9.05% and 23.34% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset.
dataset. It concludes that the proposed IACOF classifier produces higher sensitivity results when compared to all other methods.

![Figure - 5.2(b)](image)

**Specificity analysis Vs. classifiers (IACOF and Existing classifiers)**

The proposed IACOF classifier produces higher specificity results of 72% which is 8%, 12% and 16% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed IACOF classifier produces higher specificity results of 69.09% which is 4.55%, 7.28% and 10.91% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOF classifier produces higher specificity results of 72.5% which is 15%, 25% and 35% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that
the proposed IACOF based classifier produces higher specificity results when compared to all other methods.

**Figure 5.2(c)**

**Specificity analysis Vs. classifiers (IACOSAF and Existing classifiers)**

Figure 5.2(c) shows specificity analysis results of different classification methods such as IACOSAF, CSF, FKM and Fuzzy classifier. Figure 5.2(c) shows specificity results of 94.76% for IACOSAF, 78.57% for CSF, 80.95% for FKM and 66.66% for fuzzy classifier in CHD dataset.

The proposed IACOSAF classifier produces higher specificity results of 94.76% which is 16.19%, 13.81% and 28.1% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed IACOSAF
classifier produces higher specificity results when compared to all other methods.

The proposed IACOSAF classifier produces higher specificity results of 84% which is 20%, 24% and 28% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset.

The proposed IACOSAF classifier produces higher specificity results of 74.54% which is 10%, 12.73% and 16.36% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset.

Proposed IACOSAF classifier produces higher specificity results of 80% which is 22.5%, 32.5% and 42.5% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOSAF classifier produces higher specificity results when compared to all other methods.

Table - 5.3
Precision metrics Vs. classifiers

<table>
<thead>
<tr>
<th>Datasets</th>
<th>Fuzzy</th>
<th>FKM Classifier</th>
<th>CSF</th>
<th>ACOF</th>
<th>IACOF</th>
<th>IACOSAF</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTG</td>
<td>54.54</td>
<td>60.37</td>
<td>67.30</td>
<td>74.50</td>
<td>79.24</td>
<td>84.61</td>
</tr>
<tr>
<td>Abalone</td>
<td>63.49</td>
<td>68.18</td>
<td>71.11</td>
<td>73.75</td>
<td>76.71</td>
<td>81.08</td>
</tr>
<tr>
<td>Iris</td>
<td>52.17</td>
<td>61.53</td>
<td>66.66</td>
<td>70.37</td>
<td>74.074</td>
<td>84.61</td>
</tr>
<tr>
<td>CHD</td>
<td>80.55</td>
<td>88.57</td>
<td>87.67</td>
<td>93.24</td>
<td>87.610</td>
<td>97.27</td>
</tr>
</tbody>
</table>
Figure 5.3(a) shows precision analysis results of different classification methods such as ACOF, CSF, FKM and Fuzzy classifier. Figure 5.3(a) shows precision results of 93.24% for ACOF, 87.67% for CSF, 88.57% for FKM and 80.55% for fuzzy classifier in CHD dataset. The proposed ACOF classifier produces higher precision results of 93.24% which is 5.57%, 4.67% and 12.69% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed ACOF classifier produces higher precision results when compared to all other methods. The proposed ACOF produces higher precision results of 70.37% which is 3.71%, 8.84% and 18.2% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed
ACOF classifier produces higher precision results of 73.75% which is 2.64%, 5.57% and 10.26% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed ACOF classifier produces higher precision results of 74.50% which is 7.2%, 14.13% and 19.96% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed ACOF classifier produces higher precision results when compared to all other methods.

![Figure 5.3(b)](/path/to/figure5_3b.png)

**Figure - 5.3(b)**

**Precision analysis Vs. classifiers (IACOF and Existing classifiers)**

Figure 5.3 (b) shows precision analysis results of different classification methods such as IACOF, CSF, FKM and Fuzzy classifier. Figure 5.3(b) shows precision results of 87.61% for IACOF, 87.67% for CSF, 88.57% for FKM and 80.55% for fuzzy classifier in CHD dataset. The proposed IACOF classifier produces higher precision results of
87.61% which is -0.06%, -0.96% lesser and 7.06% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed IACOF classifier produces higher precision results when compared to all other methods. The proposed IACOF classifier produces higher precision results of 74.074% which is 7.414%, 12.544% and 21.904% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed IACOF classifier produces higher precision results of 76.71% which is 5.6%, 8.53% and 13.22% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOF classifier produces higher precision results of 79.24% which is 11.94%, 18.87% and 24.7% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOF based classifier produces higher precision results when compared to all other methods.

Figure 5.3(c) shows precision analysis results of different classification methods such as IACOSAF, CSF, FKM and Fuzzy classifier. Figure 5.3(c) shows precision results of 97.27% for IACOSAF, 87.67% for CSF, 88.57% for FKM and 80.55% for fuzzy classifier in CHD dataset. The proposed IACOSAF classifier produces higher precision results of 97.27% which is 9.6%, 8.7% and 16.72% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed IACOSAF classifier produces higher precision results when compared to all other methods.
The proposed IACOSAF classifier produces higher precision results of 84.61% which is 17.95%, 23.08% and 32.44% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed IACOSAF classifier produces higher precision results of 81.08% which is 9.97%, 12.90% and 17.59% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOSAF classifier produces higher precision results of 84.61% which is 17.31%, 24.24% and 30.07% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOSAF classifier produces higher precision results when compared to all other methods.

**Figure - 5.3(c)**

Precision analysis Vs. classifiers (IACOSAF and Existing classifiers)
### Table - 5.4
**F-Measure metrics Vs. classifiers**

<table>
<thead>
<tr>
<th>Datasets</th>
<th>Fuzzy (%)</th>
<th>FKM classifier (%)</th>
<th>CSF (%)</th>
<th>ACOF (%)</th>
<th>IACOF (%)</th>
<th>IACOSAF (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTG</td>
<td>57.14</td>
<td>62.13</td>
<td>68.62</td>
<td>75.24</td>
<td>81.55</td>
<td>81.55</td>
</tr>
<tr>
<td>Abalone</td>
<td>60.15</td>
<td>66.17</td>
<td>69.81</td>
<td>74.02</td>
<td>78.32</td>
<td>83.33</td>
</tr>
<tr>
<td>Iris</td>
<td>50.00</td>
<td>62.74</td>
<td>69.23</td>
<td>73.07</td>
<td>76.92</td>
<td>86.27</td>
</tr>
<tr>
<td>CHD</td>
<td>74.35</td>
<td>80.5195</td>
<td>81.52</td>
<td>87.34</td>
<td>90.97</td>
<td>95.26</td>
</tr>
</tbody>
</table>

**Figure - 5.4(a)**

**F-measure analysis Vs. classifiers (ACOF and Existing classifiers)**

Figure 5.4(a) shows F-measure analysis results of different classification methods such as ACOF, CSF, FKM and Fuzzy classifier.
The proposed ACOF classifier produces higher F-measure results of 87.34% which is 5.82%, 6.8205% and 12.99% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed ACOF classifier produces higher F-measure results when compared to all other methods. The proposed ACOF produces higher F-measure results of 73.07% which is 3.84%, 10.33% and 23.07% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed ACOF classifier produces higher F-measure results of 73.75% which is 4.21%, 7.85% and 13.87% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed ACOF classifier produces higher F-measure results of 74.02% which is 6.62%, 13.11% and 18.1% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed ACOF classifier produces higher F-measure results when compared to all other methods.

Figure 5.4 (b) shows F-measure analysis results of different classification methods such as IACOF, CSF, FKM and Fuzzy classifier. Figure 5.4(b) shows F-measure results of 90.97% for IACOF, 81.52% for CSF, 80.5195% for FKM and 74.35% for fuzzy classifier in CHD dataset. The proposed IACOF classifier produces higher F-measure results of 90.97% which is 9.45%, 10.4505% and 16.62% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed IACOF classifier produces higher F-measure results when compared to all other methods.
The proposed IACOF classifier produces higher F-measure results of 78.32% which is 8.51%, 12.15% and 18.17% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOF classifier produces higher F-measure results of 81.55% which is 12.93%, 19.42% and 24.41% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOF based classifier produces higher F-measure results when compared to all other methods.

Figure 5.4(c) shows F-measure analysis results of different classification methods such as IACOSAF, CSF, FKM and Fuzzy classifier. Figure 5.4(c) shows F-measure results of 95.26% for IACOSAF, 81.52% for CSF, 80.5195% for FKM and 74.35% for fuzzy classifier in CHD dataset.
Figure - 5.4(c)

F-Measure analysis Vs. classifiers (IACOSAF and Existing classifiers)

The proposed IACOSAF classifier produces higher F-measure results of 95.26% which is 13.74%, 14.7405% and 20.91% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed IACOSAF classifier produces higher F-measure results when compared to all other methods. The proposed IACOSAF classifier produces higher F-measure results of 86.27% which is 17.04%, 23.53% and 36.27% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed IACOSAF classifier produces higher F-measure results of 83.33% which is 13.52%, 17.16% and 23.18% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOSAF classifier produces higher F-measure results of 81.55% which is 12.93%, 19.42%
and 24.41% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOSAF classifier produces higher F-measure results when compared to all other methods.

Table - 5.5
Accuracy metrics Vs. classifiers

<table>
<thead>
<tr>
<th>Datasets</th>
<th>Fuzzy</th>
<th>FKM classifier</th>
<th>CSF</th>
<th>ACOF</th>
<th>IACOF</th>
<th>IACOSAF</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTG</td>
<td>50.00</td>
<td>56.66</td>
<td>64.44</td>
<td>72.22</td>
<td>78.88</td>
<td>84.44</td>
</tr>
<tr>
<td>Abalone</td>
<td>57.60</td>
<td>63.20</td>
<td>66.80</td>
<td>70.80</td>
<td>76.71</td>
<td>80.80</td>
</tr>
<tr>
<td>Iris</td>
<td>52.00</td>
<td>62.00</td>
<td>68.00</td>
<td>72.00</td>
<td>76.00</td>
<td>86.00</td>
</tr>
<tr>
<td>CHD</td>
<td>68.25</td>
<td>76.19</td>
<td>76.98</td>
<td>84.12</td>
<td>88.41</td>
<td>93.80</td>
</tr>
</tbody>
</table>

Figure - 5.5(a)
Accuracy analysis Vs. classifiers (ACOF and Existing classifiers)
Figure 5.5(a) shows accuracy analysis results of different classification methods such as ACOF, CSF, FKM and Fuzzy classifier. Figure 5.5(a) shows accuracy results of 84.12% for ACOF, 76.98% for CSF, 76.19% for FKM and 68.25% for fuzzy classifier in CHD dataset. The proposed ACOF classifier produces higher accuracy results of 84.12% which is 7.14%, 7.93% and 12.99% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed ACOF classifier produces higher accuracy results when compared to all other methods. The proposed ACOF produces higher accuracy results of 72% which is 4%, 10% and 20% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset.

The proposed ACOF classifier produces higher accuracy results of 70.8% which is 4%, 7.6% and 13.2% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed ACOF classifier produces higher accuracy results of 72.22% which is 7.78%, 15.56% and 22.22% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed ACOF classifier produces higher accuracy results when compared to all other methods.

Figure 5.5 (b) shows accuracy analysis results of different classification methods such as IACOF, CSF, FKM and Fuzzy classifier. Figure 5.5(b) shows accuracy results of 88.41% for IACOF, 76.98% for CSF, 76.19% for FKM and 68.25% for fuzzy classifier in CHD dataset.
The proposed IACOF classifier produces higher accuracy results of 88.41% which is 11.43%, 12.22% and 20.16% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed IACOF classifier produces higher accuracy results when compared to all other methods. The proposed IACOF classifier produces higher accuracy results of 76.00% which is 8%, 14% and 24% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed IACOF classifier produces higher accuracy results of 76.71% which is 9.91%, 13.51% and 19.11% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOF classifier produces higher accuracy results of 78.88% which is 14.44%, 22.22% and 28.88% higher when compared to CSF, FKM.
classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOF based classifier produces higher accuracy results when compared to all other methods.

Figure 5.5(c) shows accuracy analysis results of different classification methods such as IACOSAF, CSF, FKM and Fuzzy classifier. Figure 5.5(c) shows accuracy results of 93.8% for IACOSAF, 76.98% for CSF, 76.19% for FKM and 68.25% for fuzzy classifier in CHD dataset. The proposed IACOSAF classifier produces higher accuracy results of 93.8% which is 16.82%, 17.61% and 25.55% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed IACOSAF classifier produces higher accuracy results when compared to all other methods.
The proposed IACOSAF classifier produces higher accuracy results of 86.00% which is 18%, 24% and 34% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed IACOSAF classifier produces higher accuracy results of 80.8% which is 14%, 17.6% and 23.2% higher when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOSAF classifier produces higher accuracy results of 84.44% which is 20%, 27.78% and 34.44% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOSAF classifier produces higher accuracy results when compared to all other methods.

Table - 5.6

<table>
<thead>
<tr>
<th>Datasets</th>
<th>Error rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fuzzy</td>
</tr>
<tr>
<td>CTG</td>
<td>50</td>
</tr>
<tr>
<td>Abalone</td>
<td>42.4</td>
</tr>
<tr>
<td>Iris</td>
<td>48</td>
</tr>
<tr>
<td>CHD</td>
<td>31.75</td>
</tr>
</tbody>
</table>

Figure 5.6(a) shows error rate analysis results of different classification methods such as ACOF, CSF, FKM and Fuzzy classifier. Figure 5.6(a) shows error rate results of 15.88% for ACOF, 23.02% for CSF, 23.81% for FKM and 31.75% for fuzzy classifier in CHD dataset. The proposed ACOF classifier produces lesser error rate results of 15.88% which is 7.14%, 7.93% and 15.87% lesser when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset.
It concludes that the proposed ACOF classifier produces lesser error rate results when compared to all other methods. The proposed ACOF produces lesser error rate results of 28% which is 4%, 10% and 20% lesser when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed ACOF classifier produces lesser error rate results of 29.2% which is 4%, 7.6% and 13.2% lesser when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed ACOF classifier produces lesser error rate results of 27.78% which is 7.78%, 15.56% and 22.22% higher when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed ACOF classifier produces lesser error rate results when compared to all other methods.
Figure 5.6(b)

Error Rate analysis Vs. classifiers (IACOF and Existing classifiers)

Figure 5.6 (b) shows error rate analysis results of different classification methods such as IACOF, CSF, FKM and Fuzzy classifier. Figure 5.6(b) shows error rate results of 11.59% for IACOF, 23.02% for CSF, 23.81% for FKM and 31.75% for fuzzy classifier in CHD dataset. The proposed IACOF classifier produces lesser error rate results of 24% which is 11.43%, 12.22% and 20.16% lesser when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. The proposed IACOF classifier produces lesser error rate results of 11.59% which is 8%, 14% and 24% lesser error rate when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed IACOF classifier produces lesser error rate results of 23.29% which is 9.91%, 13.51% and 19.11% lesser when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOF classifier produces lesser error rate results of
21.22% which is 14.44%, 22.22% and 28.88% lesser when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOF based classifier produces higher accuracy results when compared to all other methods.

Figure - 5.6(c)

Error Rate analysis Vs. classifiers (IACOSAF and Existing Classifiers)

Figure 5.6(c) shows error rate analysis results of different classification methods such as IACOSAF, CSF, FKM and Fuzzy classifier. Figure 5.6(c) shows error rate results of 6.2% for IACOSAF, 23.02% for CSF, 23.81% for FKM and 31.75% for fuzzy classifier in CHD dataset. The proposed IACOSAF classifier produces lesser error rate results of 6.2% which is 16.82%, 17.61% and 25.55% lesser when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CHD dataset. It concludes that the proposed IACOSAF
classifier produces lesser error rate results when compared to all other methods.

The proposed IACOSAF classifier produces lesser error rate results of 14% which is 18%, 24% and 34% lesser when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in Iris dataset. The proposed IACOSAF classifier produces lesser error rate results of 19.2% which is 14%, 17.6% and 23.2% lesser when compared to CSF, FKM classifier, and fuzzy classifiers respectively in Abalone dataset. Proposed IACOSAF classifier produces lesser error rate results of 15.56% which is 20%, 27.78% and 34.44% lesser when compared to CSF, FKM classifier and fuzzy classifiers methods respectively in CTG dataset. It concludes that the proposed IACOSAF classifier produces lesser error rate when compared to all other methods.

5.4 SUMMARY

The above section analyses the performance comparison results of different classification algorithms such as CSF, FKM classifier, fuzzy classifiers and ACO based classifiers are measured in terms of sensitivity, specificity, precision, recall, F-measure, accuracy and error rate. From the results it concludes that the proposed ACO based fuzzy classifiers (IACOF, IACOSAF ) performs better for all terms when compared to other existing classifiers under four different dataset samples.