|  |
| --- |
| logo.jpg  **Computational Intelligence Course**  **Scientific Computing Department**  **Faculty of Computer and Information Sciences**  **Ain Shams University, Egypt** |
| **A Report of Final Project – (RBFN)**  **By** |

|  |  |
| --- | --- |
| **Team no.: [10]**  **[Esraa Hussein Ibrahim El-Saadawy] - [1]**  **[Merna Khalid Abdul-Aziz] – [4]**  **[Farouk Mohamed Farouk] - [3]**  **[Mohamed Yousry Yehia] - [3]**  **[Mai Alaa Mohamed] - [4]**  **[Ahmed Yehia Mahmoud] - [1]** | |
| **Project Title** | |
| **"*Epilepsy Diagnosis Using EEG Signals*"** | |

**1st Semester 2017\2018**

# **RBFN Models (Results)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 98.4% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 9 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 60% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 4 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 59.8% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 5 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 6 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 40.2% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 7 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 8 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 56% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 60% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used /Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 58.6% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 57% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 57% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 58.6% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used /Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 58.8% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 58.2% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 58.2% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 58.2% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 60% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 57.8% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 56.6% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 58.2% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 58.8% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 56.4% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 98.4% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1 /Unnormalized Data** | **Accuracy** | 58.6% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 11.2% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used /Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used /Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used /Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 98.8% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 40% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 91.4% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Not Used/Unnormalized Data** | **Accuracy** | 57.8% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

# **The Best RBFN Model**

In this section, mention the best model (that has the greatest accuracy) of your previous tried models.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | MSE | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **# Epochs** | **Input layer** | | **Hidden layer** | | **Stopping Criteria** | **Output layer** | |
| 500 | # Neurons | 20 | # Hidden neurons | 3 | Number of Epochs | # Neurons | 1 |
|  |  | |  |  | **Bias Used = 1/Unnormalized Data** | **Accuracy** | 100% |

# **Conclusion**

As the number of clusters increase, accuracy decrease and biased towards class0 which is the normal class.

Also, Bias using increase the accuracy and lead in some cases to 100% accuracy.

The stopping criteria doesn’t have a big effect on the accuracy, as it increases with both stopping criteria.