|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model |  | Fe | | | | Mn | | | |
|  | Training | | Validation | | Training | | Validation | |
|  | No | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** |
| RF | **I** | 11% | 48.8 | 19% | 91 | 28% | 54.1 | 54% | 107.7 |
| **II** | 12% | 48.3 | 19% | 91.3 | 25% | 53.5 | 58% | 114.4 |
| **III** | 12% | 47.6 | 18% | 88.9 | 26% | 54.6 | 55% | 110.1 |
| **IV** | 12% | 48.3 | 19% | 89.2 | 26% | 53.3 | 55% | 108.5 |
| **V** | 12% | 47.9 | 18% | 87.7 | 24% | 50.5 | 53% | 102 |
| **VI** | 12% | 47.2 | 19% | 88 | 23% | 50.1 | 51% | 99.9 |
| **VII** | 12% | 49.1 | 24% | 105.7 | 28% | 54 | 53% | 103.2 |
| **VIII** | 12% | 46.7 | 17% | 90.4 | 21% | 50.7 | 48% | 94 |
| **IX** | 11% | 47 | 24% | 97.7 | 23% | 51.2 | 43% | 81.4 |
| **X** | 12% | 46.8 | 18% | 86.2 | 23% | 49.2 | 57% | 103.9 |
| SVR | No | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** |
| **I** | 14% | 72.7 | 17% | 92.2 | 11% | 57.1 | 42% | 95.6 |
| **II** | 20% | 88.2 | 21% | 96.6 | 11% | 54.5 | 44% | 98.5 |
| **III** | 19% | 84 | 21% | 98.3 | 7% | 9.6 | 51% | 97.4 |
| **IV** | 21% | 89.8 | 22% | 103.2 | 7% | 9.6 | 52% | 97.7 |
| **V** | 3% | 9.8 | 21% | 99.6 | 7% | 9.6 | 52% | 97.7 |
| **VI** | 6% | 41.1 | 22% | 100 | 7% | 9.6 | 52% | 97.7 |
| **VII** | 20% | 85 | 22% | 102.4 | 34% | 98 | 38% | 101.4 |
| **VIII** | 6% | 30 | 18% | 77.6 | 25% | 85.6 | 41% | 96.1 |
| **IX** | 8% | 57.1 | 18% | 92.2 | 19% | 65.4 | 40% | 97 |
| **X** | 6% | 41.4 | 22% | 102.4 | 7% | 9.6 | 52% | 98.4 |
| Model |  | Zn | | | | Cu | | | |
|  | Training | | Validation | | Training | | Validation | |
| No | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** |
| RF | **I** | 109% | 48.7 | 178% | 93.2 | 11% | 50.4 | 30% | 117.4 |
| **II** | 113% | 50.5 | 232% | 93.7 | 10% | 46.2 | 27% | 115.8 |
| **III** | 116% | 49.2 | 233% | 91.1 | 10% | 48.1 | 27% | 113.7 |
| **IV** | 119% | 48.9 | 217% | 94.5 | 10% | 48.4 | 26% | 109.2 |
| **V** | 119% | 47.8 | 213% | 91.9 | 8% | 38.6 | 27% | 110.2 |
| **VI** | 91% | 37.5 | 241% | 83.7 | 8% | 38.2 | 27% | 112 |
| **VII** | 141% | 53.5 | 206% | 95.5 | 11% | 52.6 | 24% | 98.3 |
| **VIII** | 94% | 47.3 | 221% | 86.7 | 9% | 45.1 | 27% | 100 |
| **IX** | 68% | 36.1 | 223% | 79.2 | 10% | 48.6 | 27% | 108.3 |
| **X** | 87% | 45.8 | 304% | 99.6 | 8% | 37 | 26% | 111.5 |
| SVR | No | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** | **MAPE** | **NRMSE** |
| **I** | 45% | 22.8 | 218% | 99.4 | 11% | 62.7 | 25% | 103.7 |
| **II** | 44% | 9.9 | 260% | 97.9 | 3% | 13.5 | 24% | 101.3 |
| **III** | 44% | 9.9 | 232% | 95.5 | 3% | 9.9 | 24% | 101.6 |
| **IV** | 44% | 9.9 | 218% | 95.3 | 5% | 35.3 | 24% | 100.5 |
| **V** | 44% | 9.9 | 243% | 96.6 | 3% | 13.4 | 24% | 101.3 |
| **VI** | 44% | 9.9 | 244% | 96.1 | 3% | 9.9 | 24% | 101.6 |
| **VII** | 45% | 19.7 | 218% | 94.1 | 13% | 73 | 23% | 99.6 |
| **VIII** | 68% | 53.5 | 155% | 91.5 | 3% | 17.3 | 26% | 98.2 |
| **IX** | 43% | 9.8 | 170% | 84.4 | 18% | 87.4 | 26% | 103.6 |
| **X** | 79% | 54.1 | 263% | 106.5 | 3% | 9.9 | 24% | 101.6 |