**Table S-1.** Demographic variables and vital observations used as input variables for RNN model, along with the percent of episodes in each dataset with these measurements and the percent of timesteps with imputed values.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable Name** | **Training Set** | | **Valid Set** | | **Test Set** | |
| % Episodes w.  Measurement | % Imputed | % Episodes w. Measurement | % Imputed | % Episodes w. Measurement | % Imputed |
| Age | 100.0 | 0.0 | 100.0 | 0.0 | 100.0 | 0.0 |
| Gender | 100.0 | 0.0 | 100.0 | 0.0 | 100.0 | 0.0 |
| Abdominal Girth | 9.3 | 99.6 | 8.9 | 99.6 | 9.6 | 99.6 |
| Activity Level | 78.7 | 97.2 | 76.7 | 97.3 | 78.0 | 97.1 |
| Bladder pressure | 1.4 | 99.9 | 1.2 | 99.9 | 1.0 | 99.9 |
| Capillary Refill  Delayed | 66.5 | 92.8 | 69.1 | 92.1 | 67.8 | 92.0 |
| Capillary Refill Rate | 99.8 | 79.5 | 99.8 | 79.2 | 99.8 | 79.0 |
| Central Venous  Pressure | 15.7 | 93.8 | 15.6 | 93.6 | 16.0 | 93.4 |
| Cerebral Perfusion   Pressure | 4.7 | 98.0 | 4.6 | 98.3 | 4.3 | 98.3 |
| Diastolic Blood  Pressure | 100.0 | 52.7 | 100.0 | 52.8 | 100.0 | 52.3 |
| EtCO2 | 35.3 | 76.4 | 37.0 | 75.2 | 34.5 | 76.9 |
| Extremity   Temperature Level | 100.0 | 78.9 | 100.0 | 78.6 | 100.0 | 78.3 |
| Eye Response Level | 100.0 | 78.0 | 100.0 | 77.6 | 100.0 | 77.2 |
| FLACC Pain Activity | 80.2 | 83.1 | 80.6 | 83.3 | 79.8 | 82.9 |
| FLACC Pain   Consolability | 80.2 | 83.1 | 80.6 | 83.3 | 79.8 | 83.0 |
| FLACC Pain Cry | 80.2 | 83.1 | 80.6 | 83.3 | 79.8 | 83.0 |
| FLACC Pain Face | 80.2 | 83.1 | 80.6 | 83.3 | 79.9 | 82.9 |
| FLACC Pain Intensity | 80.1 | 83.2 | 80.6 | 83.3 | 79.8 | 83.0 |
| FLACC Pain Legs | 80.2 | 83.1 | 80.6 | 83.3 | 79.8 | 82.9 |
| Foley Catheter  Volume | 42.9 | 89.8 | 42.5 | 89.9 | 43.0 | 90.0 |
| Gastrostomy Tube  Volume | 10.9 | 99.4 | 11.4 | 99.6 | 11.2 | 99.5 |
| Glasgow Coma Score | 100.0 | 78.1 | 100.0 | 77.8 | 100.0 | 77.4 |
| Head Circumference | 17.1 | 99.9 | 16.6 | 99.9 | 16.4 | 99.9 |
| Heart Rate | 100.0 | 41.9 | 100.0 | 40.9 | 100.0 | 40.9 |
| Height | 95.8 | 99.2 | 95.7 | 99.2 | 95.8 | 99.2 |
| Hemofiltration Fluid   Output | 2.2 | 98.5 | 2.3 | 98.4 | 2.0 | 98.5 |
| Intracranial Pressure | 4.9 | 97.2 | 4.9 | 97.7 | 4.7 | 97.5 |
| Left Pupil Size After  Light | 97.5 | 87.4 | 98.0 | 87.1 | 98.3 | 86.4 |
| Left Pupil Size Before   Light | 98.4 | 86.4 | 98.5 | 86.1 | 99.2 | 85.5 |
| Left Pupillary  Response Level | 98.7 | 85.9 | 98.8 | 85.7 | 99.3 | 85.1 |
| Level of  Consciousness | 99.9 | 69.8 | 100.0 | 69.1 | 100.0 | 69.1 |
| Lip Moisture Level | 66.8 | 88.0 | 66.6 | 88.5 | 65.6 | 88.0 |
| Mean Arterial   Pressure | 100.0 | 53.0 | 100.0 | 53.2 | 100.0 | 52.6 |
| Motor Response Level | 100.0 | 78.0 | 100.0 | 77.6 | 100.0 | 77.2 |
| Nasal Flaring Level | 98.9 | 72.8 | 99.2 | 72.0 | 99.2 | 72.3 |
| Nutrition Level | 65.0 | 98.3 | 63.5 | 98.3 | 64.8 | 98.2 |
| Oxygenation Index | 10.6 | 99.5 | 10.0 | 99.4 | 10.2 | 99.5 |
| PaO2 to FiO2 | 11.6 | 99.3 | 11.0 | 99.3 | 11.2 | 99.4 |
| Patient Mood Level | 99.7 | 76.2 | 99.9 | 75.9 | 99.8 | 75.6 |
| Pulse Oximetry | 100.0 | 41.0 | 100.0 | 40.0 | 100.0 | 40.0 |
| Quality of Pain Level | 94.7 | 82.4 | 95.2 | 82.4 | 94.9 | 82.2 |
| Respiratory Effort   Level | 99.9 | 72.2 | 100.0 | 71.4 | 100.0 | 71.7 |
| Respiratory Rate | 100.0 | 42.0 | 100.0 | 41.0 | 100.0 | 41.1 |
| Right Pupil Size After   Light | 97.7 | 87.3 | 98.2 | 87.1 | 98.5 | 86.3 |
| Right Pupil Size   Before Light | 98.4 | 86.4 | 98.6 | 86.0 | 99.2 | 85.5 |
| Right Pupillary   Response Level | 98.7 | 85.9 | 98.9 | 85.6 | 99.3 | 85.1 |
| Sedation Scale Level | 40.8 | 98.3 | 40.7 | 98.4 | 40.5 | 98.3 |
| Skin Turgor\_edema | 12.0 | 97.8 | 11.7 | 97.7 | 11.4 | 98.0 |
| Skin Turgor\_turgor | 99.1 | 82.2 | 99.1 | 82.1 | 99.2 | 81.5 |
| Systolic Blood   Pressure | 100.0 | 52.7 | 100.0 | 52.8 | 100.0 | 52.3 |
| Temperature | 99.8 | 84.1 | 99.8 | 83.7 | 99.9 | 83.6 |
| Verbal Response   Level | 100.0 | 78.0 | 100.0 | 77.7 | 100.0 | 77.3 |
| WAT1 Total | 6.4 | 99.4 | 6.9 | 99.3 | 7.0 | 99.4 |
| Weight | 100.0 | 97.9 | 100.0 | 97.9 | 100.0 | 97.8 |

See Table S-5 for acronym expansions ().