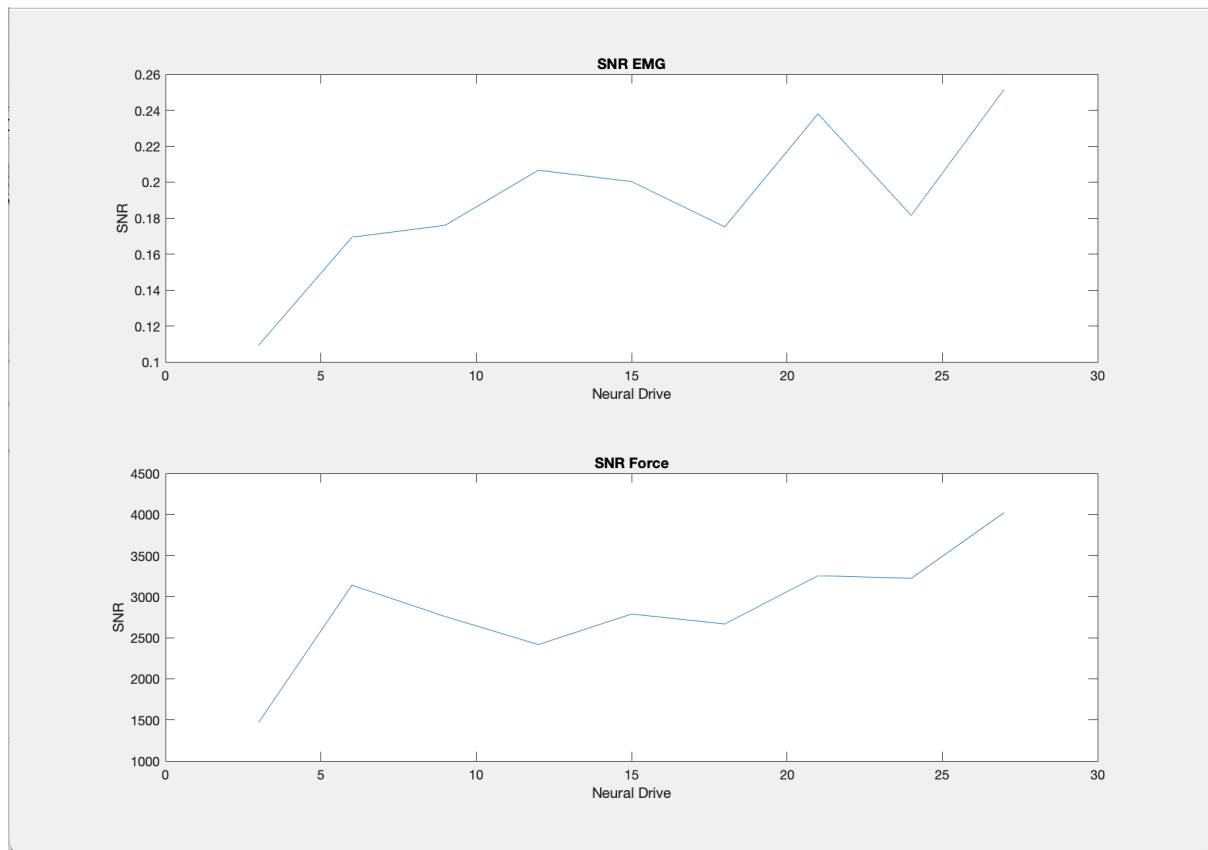


Question 7



For the SNR EMG plot, it can be observed that in general, as the level of neural drive increases, the SNR increases. At a lower level of neural drive, there are fewer motor units (MUs) that are recruited, thus overall fewer MU action potential trains (MUAPs). This is because fewer MUs at low neural drive means that there are smaller firing rates, fewer firing timings, and overall fewer MUAPs. When the neural drive increases, more and more MUs are recruited (small and large), the already recruited MUs also increase firing rates, leading to more firing timings, and thus more MUAPs. Thus, there is more signal that can be collected at higher neural drive resulting in higher SNR.

For the SNR Force plot, in general, as the level of neural drive increases, the SNR increases as well. As mentioned, at lower neural drive, fewer MUs (only those that can achieve the threshold) are recruited. These early recruited MUs primarily innervate type S muscle fibres, which have slow twitch and small force. Conversely, as the neural drive increases, more and larger MUs may get recruited, increasing the overall force output. This is because MUs with larger thresholds innervate type FF muscle fibres, which generate fast twitch and large force. Also, the firing rates increase for all MUs as the neural drive increases leading to more firing times. Thus, at higher neural drive, larger SNR can be observed, since there is more overall signal.

Also, at some neural drive levels there are unexpected peaks and valleys (e.g, $E = 21$ and $E = 24$ in SNR EMG plot). This is likely due to the alignment of action potentials in the MUAP trains of newly recruited motor units. During common timestamps across all MUs, some newly recruited MUs may have action potentials in the depolarization or repolarization range, leading to increased or decreased EMG/Force values, respectively. This is because there is no relation between recruited MU and its level of action potential or generated force (i.e, not steadily increasing or decreasing).