3 Methodology

3.1 Proposed Method of Capture and Recognition

This section proposes and justifies the method of motion capture to be used in conjunction with a proposed neural network – the architecture of such can recognise gestures based on the capturing method employed. As different capturing techniques capture different motion data not all network architecture can be used with certain capture techniques – only a fine selection of such can be used for certain capturing techniques.

Critically gesture recognition for drones need to be as responsive as possible and so the solution must be of low-latency. By low-latency, it is to be considered as the time taken between the moment the user performs the gestures to the moment that the drone receives respective commands associated with the gestures preformed. The product solution of this project will be evaluated critically on this aspect along with the accuracy of the network architecture in recognising individual gestures with the approached capturing technique.

3.2 Justifying Method of Capture

The method of approach is chosen through an elimination process with criteria. It is not difficult to isolate the effective method of capture to use among those mentioned in the related works section of this report. The most effective method simply need to meet the criteria ideally fit for drone control. The criteria are as follows: the method can be made portable enough for users to interact with their drone outdoors, the method must integrate efficiently within the system – being not a major component that caps the system's overall performance, the method must provide feeds with good entropy to cater for all the different gestures that can be made, and that the method is ideal with the neural network recognition technique.

Flex sensing methods cannot track orientations as what is tracked is only flexion therefore does not meet the criteria for good entropy for gestures. Mechanical motion tracking with potentiometers makes a potential candidate method however due to the need of braces that would require holding the potentiometers in place may impose physical constraints to the user and furthermore may succumb the user to rigid movements. Using images for gesture recognition requires image sensors to be placed stationary – this simply would be inconvenient for outdoor uses and so that not meet the criteria for drone uses.

The chosen method of motion capture that meets the criteria for this project is motion capture through IMU devices. IMUs are small electronic components that can be very precise and reading from the device can give immediate values. The significant reason as to why this method is chosen lies in the fact that this method of capture handles only three to six bytes – three of gyrometer data and another three of accelerometer data). To stress this significance, compare this to using images for motion capture, that approach would need to compute over the numbers of Bytes present within the image whereas through IMUs significantly less. This is an advantageous method as computing over a small set of data will drastically reduce the computational power required for the recognition process hence would theoretically yield low-latency results – a critical specification that would prove the significance of this project.

3.3 Justifying Network Variant for Method of Capture

When considering a neural network architecture, it is worth noting the type of input such network is meant to take in. For the case of project IMU data consists of radial orientation values and linear accelerations. Using Binary Threshold or Sigmoidal functions would not be coherent with radial values as when a value passes a certain threshold the neuron activates for linear based functions. With orientations, the values need to be computed with respect to a given point not whether the value is within threshold ranges. The Binary Threshold and the Sigmoidal functions will not be used for this project as the chosen method of capture requires network architectures that can compute on radial fields (orientations).

As radial basis function networks are functionally equivalent to neuro-fuzzy hybrid networks, either will suffice for this project. As there is general speculation whether to really say each are unique or whether they are similar, this project will attempt to employ such under the term ‘radial basis function network’ (RBF network). Relevant optimisations that may be required will be made to the network in due course of development.