1.1 Biological Learning and Robotics

Conventional methods for navigation use a representation of ~~the~~ a robot along with ~~and~~ the environment, independent control system, object recognition, occupancy map, and complex controllers. These ~~methods~~ elements are difficult to tune in the real world and require labeled data and ~~hand~~ custom engineering ~~by~~ from ~~human~~ developers. Humans, animals, and ~~even~~ some insects are very good at generalizing from past experiences by~~.~~ ~~They~~ achieving~~e~~ a high level of meta-learning ~~by~~ through deriving ~~a~~ multi-dimensional representations of the real world from ~~their~~ high dimensional sensory inputs. A combination of reinforcement learning and hierarchal processing ~~is~~ can be utilized to fit ~~the~~ acquired knowledge into new situations ~~in a very~~ efficiently ~~way~~ [1][2]. This natural learning approach is too intricate and ~~hard~~ difficult to replicate using sequential programming.

Learning from past experiences and generalizing are~~is~~ ~~a~~ challenging tasks as ~~it is~~ defined by~~in~~ what is commonly known as the plasticity-stability dilemma [3]. ~~But w~~We are particularly interested in nature's approach for learning in robotics applications because developing a model and engineering it ~~by human developers~~ does not scale well in real ~~-~~ life [4]. Recent advances in ~~reinforcement learning (~~RL~~)~~ and deep learning (DL) ~~made RL that~~ mimic~~s~~ ~~the~~ biological learning ~~possible~~ [5]. For example, Mnih et al. [6] successfully demonstrated ~~T~~this ~~technique~~ capability ~~was successfully demonstrated~~ by ~~Mnih et al. [6] who~~ training~~ed~~ an agent on how to play games. ~~-~~The authors used raw pixels as input to train a ~~D~~deep-Q network and generalized the algorithm for training agents to play a ~~large set~~collection of video games. RL has~~is~~ also been ~~u~~used to solve more complex tasks, such as ~~like~~ teaching a robot how to walk ~~(Haarnoja et al.~~[7]~~)~~.

Following these advancements, ~~W~~we ~~a~~consider ~~sk ourselves the question: what~~ if we can~~could~~ teach a drone using deep reinforcement learning (DRL) ~~on how~~ to avoid obstacles and intercept another drone or a~~n~~ specific object using only forward-facing cameras~~. using DRL?~~ Developing such a technique ~~The success of this approach~~ is significant for ~~in~~ robotics because ~~it means that~~ many ~~countless~~ complex tasks could ~~can~~ also be solved using this ~~same~~ approach.

Commented [MTD1]: Each item in the previous list could not be described as a "method" or a "process," such as the environment, so "elements" is a recommended alternate word choice to be inclusive of all items.

Commented [MTD2]: This requires a citation.

Commented [MTD3]: Presumably, more than one multi-dimensional representation is formed during our experiences, so this could be plural.

Commented [MTD4]: Just being intricate is not sufficient to avoid sequential programming, so this emphasizes a more extreme condition that warrants a new approach.

Commented [MTD5]: You list more than one task, so this verb must be plural.

Commented [MTD6]: This acronym was previously defined as reinforcement learning in the document, so you do not need to state it again, even if you are in a subsequent chapter.

Commented [MTD7]: Maintain consistency in sentence spacing.

Commented [MTD8]: For consistency, you should include your citations with the same format throughout your document. So, your approach thus far suggests your format should not include the author(s) name unless included inline with the sentence context.

Commented [MTD9]: Asking a question in a technical document such as this is awkward to read for your target audience as it is wordy and not direct. This suggested re-write is more efficient and clearly expresses your problem statement.