Response to Master Thesis Reviewers' Comments

<table>
<tr><td rowspan="3">Thesis Title</td><td colspan="6" rowspan="3">基于进化算法的蝙蝠机器人控制参数优化</td><td>Full Name</td><td>安 武</td></tr>
<tr><td>Student ID</td><td>2022280136</td></tr>
<tr><td>Discipline/ Professional Degree Category</td><td>机械工程</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>Supervisor</td><td>张云 副研究员</td></tr>
<tr><td>Reviewer 1</td><td>XS-G-012-2024-024-01</td><td>Title</td><td>副研究员</td><td>Doctoral Supervisor or not</td><td>No</td><td>Review Due Date</td><td>2024-05-03</td></tr>
<tr><td>Review Comments</td><td colspan="7">Overall rating: B
Detailed ratings: 选题意义: 优; 综述水平: 良; 新见解: 良; 理论知识: 良; 写作水平：良</td></tr>
<tr><td>Reviewer 2</td><td>XS-G-012-2024-024-02</td><td>Title</td><td>副研究员</td><td>Doctoral. Supervisor or not</td><td>No</td><td>Review Due Date</td><td>2024-05-06</td></tr>
<tr><td>Review Comments</td><td colspan="7">Overall rating: A
Detailed ratings: 选题意义: 良; 综述水平: 良; 新见解: 良; 理论知识: 良; 写作水平：良</td></tr>
<tr><td colspan="8">Response to Reviewer 1's comments</td></tr>
<tr><td colspan="8">I am very thankful for you comments and feedback that allow the thesis to obtain a much higher quality level. Following you will find the corrections made in the thesis thank to your observations.

1. 论文的结构有待调整，第 4 章中涉及到了第 6 章的内容；

Following your advice, as well as the other reviewers advice who recommended narrowing the scope of the thesis, we decided to eliminate chapter 6 as a whole and integrate its content in chapter 4. Chapter 6 only spoke of the improvements made in the Batbot, we now realize that the content fits better in chapter 4 as it is needed to explain the experiments that were carried out. For this reason we integrated the improvements of the Batbot as a result of the experiments carried out. We believe this to give a much more organic and comprehensive lecture of the thesis as the impact the result of the experiments had on the design can be directly traced and applied. Thank you for pointing this out.</td></tr>
</table>

2. 图的风格应当统一，部分图表背景为黑色，建议改为白色；

We now understand the importance of maintaining a common and professional format in the graphs presented. Therefore, all the graphs that had a black background have been redone to have a white background and follow the common format of a white background.

The figures that were improved were:

3.7, 3.8, 4.10, 4.11, 4.16, 4.17, 4.21, 4.23, 4.24, 4.25, 4.26, 5.9, 5.11, 5.13, 5.15, 5.17, 5.18

3. 实际拍摄图片中缺少必要的标注，如图 3.9，图 6.1 等；

Thanks to your advice we found many Figures that would benefit for a more descriptive caption. This way the reader can obtain the whole necessary information that we tried to portray with the Figure.

The figures that, whose caption was further developed are:

3.9, 6.1, 2.5, 3.2, 3.6, 3.7, 3.10, 3.11, 4.1

4. 部分图的坐标轴没有标明单位；

It is clear that for correct scientific portray of information in a graph, the units and the correct axis label is of outmost importance, thanks to your advice the thesis got closer to the scientific level we wish to achieve. We found many graphs that had not only no units but also confusion labels, for this reason several graphs were improved to get a reasonable axis label accompanied with their respective unit in square brackets, ej. “[N]”.

The Figures whose axis labels and unit addition were implemented were:

3.7, 3.8, 4.16, 4.17, 4.21, 4.23, 4.24, 4.25, 4.26

5. 图 4.12-4.14 元素排列复杂，难以解析，建议更改可视化方式；

We now realize that trying to present the results of a 3D plot in a 2D surface has its shortcomings and if possible should be avoided. We have created a completely new way of showing the same information which is much clearer and visually pleasing. Instead of one 3D plot, where we tried to portray the influence the motor power and attack angle had on the score, we made two 2D plots, one for the motor power and the other for the attack angle. The color bar represents the generation of the experiment. In this new plot we can clearly see that the score reduced with each experiment, as the yellow experiments showed consistently the lowest scores. And we could also showed that the results of the 3 different optimization sessions showed the same result, proving the robustness of the results obtained. We would like to remind that the axis have no units, as the values shown are unit-less because this plots

refer to the CMA value, which works on the realm of [0, 1] and is unit agnostic.

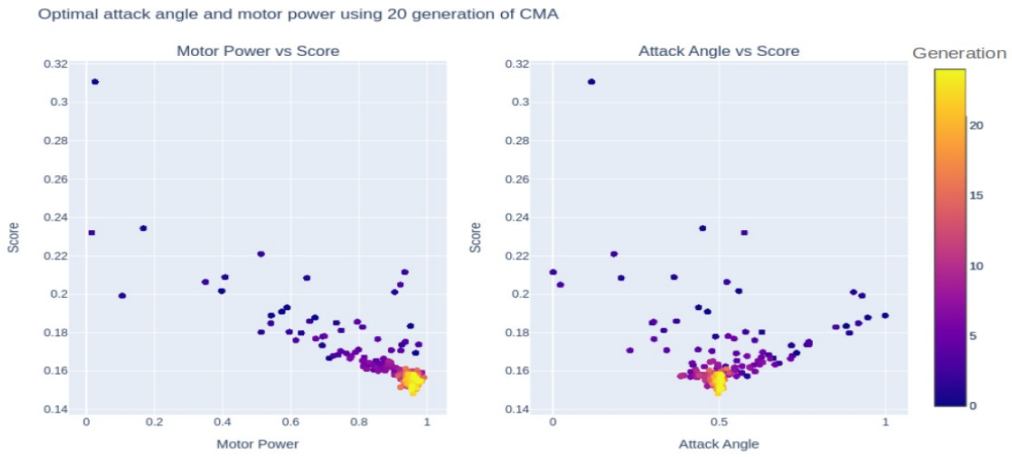

Figure 4.12 Optimal attack angle and motor power using 20 generation of CMA

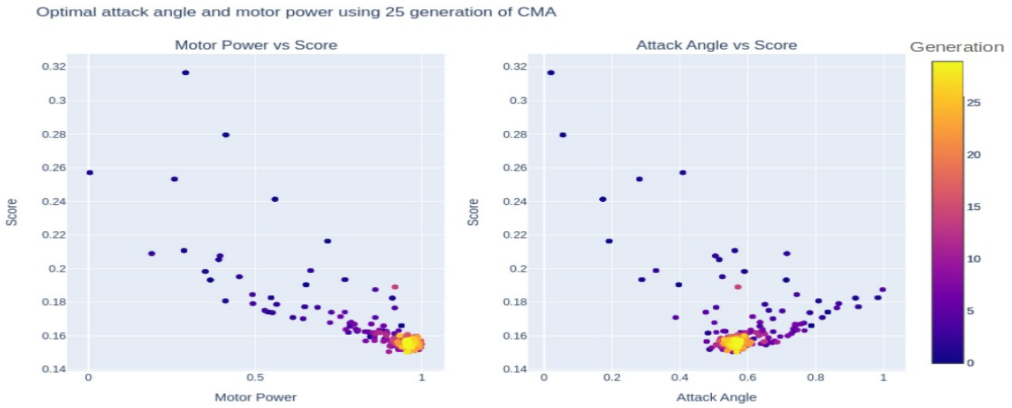

Figure 4.13 Optimal attack angle and motor power using 25 generation of CMA

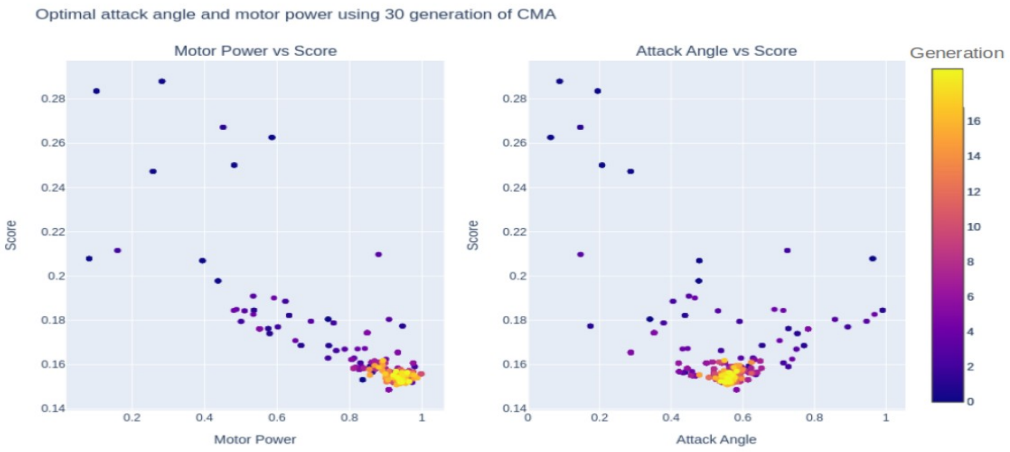

Figure 4.14 Optimal attack angle and motor power using 30 generation of CMA

6. & 7.

数学符号使用不规范，向量应当用粗体表示；

公式（4.9）-（4.10）之间的表述不明确，各个符号含义不清，建议重新表述。

We understand that the definition of the feed-forward controller as a vector function was indeed confusing. We tried to mix controlling theory and machine learning vernacular but at the end what was supposed to be a clear fit all definition turned out to be confusion. Also the attempt of explaining the function using an example was not very clear, as the example did not completely represent a real situation. For this reason we decided to define the function following the mathematical standard, as seen in the new equations 4.9-4.12:

With this, FFC can be formally described as:

$$cyc\_pi \in [0, 2\pi] \tag{4.9}$$

$$x\_angle \in [-60, 60] \tag{4.10}$$

$$y\_angle \in [-60, 60] \tag{4.11}$$

$$FFC : cyc\_pi \longrightarrow \begin{pmatrix} y\_angle \\ x\_angle \end{pmatrix} \tag{4.12}$$

and we decided to eliminate the confusing example and directly define the function to our application, as seen in equation 4.16

$$FFC(cyc\_pi) = \begin{pmatrix} y\_neutral - y\_amp \cdot \cos(cyc\_pi) \\ x\_neutral + x\_amp \cdot \sin(cyc\_pi + 2\pi \cdot ellipse\_angle) \end{pmatrix} = \begin{pmatrix} y\_angle \\ x\_angle \end{pmatrix} \tag{4.16}$$

Of course, in the chapters a detailed explanation of how we define 4.16 can be found. A very important aspect of the scientific method is the reproducibility of the experiment, for which the methods used must be clear enough to be replicated, with your valuable comment we believed to have made the work more understandable for others to replicate if desired. Thank you.

Response to Reviewer 2's comments

I am very thankful for your positive response of my thesis and for having the time to help me further improve it. Here you can find the corrections made based on your valuable comment.

（1）论文中存在一些拼写错误，比如第 2 页中的 anonimous、controllling 等；

A spelling check of the whole thesis was carried out, correcting all the mistakes found and thus improving greatly the quality of the thesis.

（2）建议适当缩小研究范围，针对某些点进行更深入的研究。

I am thankful for this comment, both you and the other reviewer commented on the need of restructuring. Following your advice, I decided to eliminate chapter 6 (which talked about the design optimizations) and integrate its information as conclusion of the individual experiments that helped us improve the Batbot. This way, following your advise, we focus less in the mechanical design and lay more focus on the algorithm development and the experiments carried out, as well as their results. This way we narrow down the focus of the thesis, and in future works (PhD) we will deepen the experiments that were here proposed. Thank you for this valuable comment.

Student's signature:

Date: 2024-05-14

Supervisor's comments:

安武同学已经按照评审意见认真修改了论文，作为导师我同意他申请硕士学位论文答辩。

Supervisor's signature: Zhang Yun Date: 2024-05-16