Exploring the Effects of Change in Input Nodes in Average Best Fitness Level

Introduction:

Background Information:
The variable I have chosen is the amount of Radars per car, this affects the amount of data in the NN therefore affecting the fitness level greatly.

Research Question:
How does change in the amount of Radars affect the average fitness level?
What are the results on different maps?

Hypothesis:
The belief is that by increasing the radar amount, the average best fitness will increase on an anti-logarithmic scale.

Justification:
The Amount of radars is crucial to learning ways to maneuver around their environment. Manipulating the amount of radars is brilliant for understanding and reinforcing our knowledge around fitness and genetic algorithms. We already know that a Neural Network that is too small won't be learning as efficiently as possible, but a Neural Network that is too big can just memorize the path/data and won't actually learn. Therefore changing the amount of input nodes gives us insight on how size of Neural Networks affects its learning process.

Methodology:

Variables:
The Independent Variable will be the amount of radars. And the dependent variable will be the level of fitness over an amount of generations. The number of generations to record, the population, and the time per each generation will be our control variables.
Generations: 5
Population: 30
Time: default

Data Collection:

I collected the data by adding a mod to the code that allowed me to record the fitness. This will be done by writing the information i.e Fitness on a new line of a file named 'results.txt'. I can then use this data to find a mean for each test.

Code:

```
        genomelist = []
        genomelist.append(genomes[0][1].fitness)

        if current_generation == 2:
            with open('results.txt', 'w') as f:
                f.write('\n' + str(max(genomelist)) + '')
        else:
            pass
```

Results:

Presentation of Data:

Average calculation:

$$A_m = \frac{Trial\ 1 + Trial\ 2 + Trial\ 3}{3}$$

<u>Map 1:</u>

Number of sensory radars	Best fitness rounded to nearest 100th			Average best fitness
	Trial 1	Trial 2	Trial 3	
3	2832.88	6387.68	8122.40	5780.986667
5	575520.0	575520.0	588875.52	579971.84
7	575520.0	448828.4	1220480.56	748276.32

Map 2:

Number of sensory radars	Best Fitness rounded to the nearest 100th			Average Best Fitness
	Trial 1	Trial 2	Trial 3	
3	445.36	445.28	896.0	595.55
5	575520.0	347800.0	346270.4	423196.8
7	89644.0	284596.8	575520.0	316586.9333

Map 3:

Number of sensory radars	Best Fitness rounded to the nearest 100th			Average Best Fitness
	Trial 1	Trial 2	Trial 3	
3	744.48	280.48	1179.68	734.85
5	4947.2	2280.0	3648.0	3625.06
7	29548.0	11942.08	67711.28	36400.45

Data Interpretation:

Noting the trends and patterns of each of the tables, here are my observations from the patterns in the data:

- There are multiple instances of best fitnesses that are the value 575520.0. This might be due to recurring events that happen due to random chance, which is something to improve on if we were to do this again.
- Increasing the number of sensors almost always changed the average best fitness. This is except for map 2, where the average best fitness with 7 radars seems to be 100,000 less than the average best fitness with 5 radars.
- Average best fitness, for maps 1 and 3, seem to sharply increase its value from when the amount of radars are 3 and 5. Then the value plateaus when the number of radars go from 5 to 7
- The range of individual trials are far too great compared to its average value, indicating that more trials are required to calculate a more realistic average for the trails
- Most of the values for Trial 2 were the lowest scoring best fitness for that respective number of radars than all other Trial

Discussion:

Comparison to Hypothesis:
The data concludes that for some of the maps the best average fitness increases on an anti logarithmic scale was correct. However, noting the outlier of this trend, draws that this hypothesis may be correct only on certain maps.

Suggestions for Further Research:
In order to achieve results that are real and true, more trials and more radars are necessary in order to hone-in on more accurate averages therefore leading to more accurate results

Conclusion:
As we can draw from the interpretation of data, we can answer that by changing the amount of radars per car we can see that, although dependent on the map used in the simulation, an increase of fitness level is dependent on the increasing amount of sensory radars. We can also include that increasing the amount of radars does not always conclude in further increase of fitness level. Furthermore from these 2 main extracts from the data we can conclude that certain maps have a unwritten specified amount of radars that result in the best average fitness