

Genetic Algorithm with insect robot

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The fields of robotic and artificial intelligence experience evolutionary changes. Day by day more sophisticated techniques and robots with higher performance are available on the market. The importance and interest in research in the fields of adaptability and learning methods will increase in the years to come. These facts inspired us to realise a robot, which can move like an insect on 6 legs.

Artificial Intelligence

Mainly two methods are used for artificial intelligence, the neural networks and the genetic programming. The neural networks imitate the basic concept of the human brain. Already existing applications are for example image analysis or stock market predictions. The second domain is the genetic programming. This technique is based on Charles Darwin's theory of evolution. As the word «genetic» implies, the code generates populations and allows them to mutate and recombine. A selection is made, so only the best survives each generation.

Many other techniques exist, mostly each for a certain kind of applications.

We chose to use a genetic algorithm, as it seemed to fit the best the requirements of our problem. Furthermore we had some experience with it and assumed it to be more interesting than the other options.

Genetic Algorithm

A genetic algorithm is one approach to genetic programming. In a genetic algorithm different functions work together as follows. The programmer creates a DNA specified to the particular problem. The DNA contains the variables of the program we want to improve (like in biology). A function will change these parts of the DNA with the result of a change in the programs functionalities. Then, the next function has to evaluate the performance. If the behaviour of the actual DNA comes closer to a given goal, than its parent, the DNA is kept in memory and is the base for further mutations. Otherwise the DNA will be erased. As a consequence the program will ever improve to a given goal.

Our Thesis

We have been evaluating and assembling the complete robot, all mechanical and electronic components. The core of our electronics is an ARM Cortex M3 Processor. A compass, two ultrasonic range finders, an accelerometer and the consumption of the robot deliver the necessary information to evaluate the fitness of each DNA. We designed the circuit with all electronic parts and interfaces. All drivers for the sensors and actuators were written. A big challenge were the functions steering all the different movements, as there is a huge number of variables, that need to be mutated by the genetic algorithm. At last we added the genetic algorithm. To test the different movements, we found the solutions to command the robot with the Nintendo Wii controller plus a program, which allows the robot to operate autonomous. After running only for a few minutes there are significant changes in the speed and manner of the robots walk.



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