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# Safety Critical Systems AX Report (H)

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Andrei-Mihai Nicolae  
2147392n@student.gla.ac.uk

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## 1 INTRODUCTION

Artificial Intelligence has been one of the hot topics of this decade as it is surrounding our lives more as days go by. We can see it in objects ranging from aircrafts to smart home controllers.

However, as AI has become so powerful, it may come with a cost for the majority of us. Because of the large number of risks when letting Artificial Intelligence and Machine Learning robots/devices perform certain actions for us (Mannino [2015]), we need to devote a huge amount of effort in designing better safety-oriented architectures, well-crafted and thorough testing as well as regular check-ups and revisions. Therefore, we need to see a considerable increase in tools that assess and mitigate risks when introducing AI into systems of any type. Such a tool will be discussed in further detail in this report.

## 1.1 AI-DRIVEN TECHNOLOGIES

The importance of introducing AI into a field with safety as a top priority is crucial. Because there is no human involved, the goal of the whole AI community is to let the machines actually take our place in performing certain actions, so that our tasks would be simplified. As good examples where it has become more and more developed, here is a list of examples:

- Transportation (driverless cars, subways)
- Game playing machines (Deepmind's Go playing machine that beat the en-titre champion) Silver [2016]
- Medical robotics
- Manufacturing machines
- Education

As the list can go on, we can see how AI spans throughout most of the major aspects of our lives, thus the need of careful monitoring its development.

## 1.2 HOW AI CAN GO WRONG

Going past the many fields driven by Artificial Intelligence nowadays, we need to also take a close look at how many technologies have proven to be very prone to failure.

One interesting case is something that happened only a few months ago with an Uber driverless car going through a red light in front of San Francisco's Museum of Modern Art (Wakabayashi [2015]).

As it was recorded on camera, the car just rushes through a busy street on red light. This is a clear sign of how developers are not placing enough testing and robust checks before launching such a safety critical systems into an open environment.

We can see that the cause of the previous example could have been harmful for us humans. However, there have been cases where AI was involved and it was even deadly. Such an event is the killing of a Volkswagen employee who was grabbed and killed by one of the manufacturing robots in the plant (Dockterman [2015]). Moreover, a robot in one Silicon Valley mall struck a child on the head by mistake (Rocha [2016]).

In conclusion, after discussing various developments in the Artificial Intelligence world and how these safety critical systems can fail drastically, a tool for assessing and mitigating such risks will be presented in the rest of this report.

## 2 DEVELOPED TOOL

After extensive research, I came to the conclusion that for such an application the best technique that should be used is Model Checking adapted specifically for AI systems.

### 2.1 REASONS BEHIND CHOICE

Firstly, it's needed to be pointed out that various techniques (e.g. Fault Tree Analysis, Effects and Criticality Analysis) work as well for some sub-fields of AI-driven systems, but I believe that Model Checking is eventually the optimal choice. This is because of various reasons which will be exposed below.

#### 2.1.1

### 2.2 EXAMPLE OF LIST (ENUMERATE)

1. First item in a list
2. Second item in a list
3. Third item in a list

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