Title: Learning General Preconditions Based on Single Data Points

Topic:

The autonomous cars of the future will have approx. 300 MLoC and are thus to large for state-of-the-art solvers to be analysed. The aim of the analysis is to find errors in a program or prove their absence. A promising approach is to partition the program into smaller *modules* and analyse them separately. To be able to analyse them separately, we will need Pre- and Postconditions of these modules. Our current approach, bounded model checking, can generate single data points as preconditions. For example, an invalid function call with parameters x=3 and y=5.

Based on these single data points, a learning approach should generalize these single value assignments to a general precondition, which could for example be x<y. As an input vector the single data point can be enriched by program syntactic and/or semantic. Furthermore, it is easy to generate a high number of data points. The final goal of this work would be an approach that generalizes from single value assignments to a complete precondition eliminating all possible errors in the given module.

Simple Example:

```c
// Single Data Point for error: (speed = -5, dist = 1)
// General Precondition: (speed != -5 || dist <= 0)

int neededSpace(int speed, int dist){
    int space = 0;
    speed = speed + 5;
    if(dist > 0){
        space = dist/speed; // error at (speed == 0)
    }
    return space;
}
```

Possible Task Description:

- Design learning approach for automated precondition generation
- Gather data: (1) single data points for errors, (2) program information, (3) maybe more …
- Train your learning approach for simple programs and probably adjust your model
- If the approach works, we can apply the approach to real-world applications from the automotive sector

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Possible Number of Participants: 1 to 2 persons (if a group of more then two persons want to work on this project, the scope can be lifted with our consultation)