Efficient Static Impact Analysis

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Impact analysis has a main role in many software engineering tasks such as software maintenance, regression testing, debugging. We present an alternative way to determine the impact sets of methods by applying the *Static Execute After (SEA)* relation among them. The methods f and g are in SEA relation if any part of the method g could execute any part of the method f. This technique is suitable for real size programs with over thousands lines of code where the application of a slicer, which is considered as the most precise solution in impact analysis, cannot be carried out. This way, the technique could be widely used in the field of impact analysis.

To compute the SEA relations we introduce the *ICCFG* graph, which is a more detailed representation of the program than a simple call graph, but more compact than the system dependence graph, which is the base of slicing. We present a suitable traversal on the ICCFG graph which determines the SEA set of a particular method and, in addition, we give an algorithm that computes the sets of these relations for each method in the same time.

We prove with experimental results that the computed sets can approximate the sets of sliced methods computed by a precise slicer, and this way, we can approximate the real impact sets as well. Since the introduced algorithms are based on much fewer dependencies than the slicer, and they work on a more compact graph representation, they are more convenient to use especially in the case of large, real size programs. At the same time, the precision declines very slightly, by some 4% on average.

An interesting spinoff of our experimental results was the fact that the dependencies computed by the nowadays used slicers can be more conservative than it would be rational. The most important consequence of this behavior is that in some cases the forward slice is not the dual representation of the backward slice, which is anyway an expected property. We also investigate this problem.

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