ClrFreqCFGPrinter: A Tool for Frequency Annotated Control Flow Graphs Generation

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ABSTRACT

Recent LLVM distributions [1] have been offering the option to print the Control Flow Graph (CFG) of functions in the Intermediate Representation (IR) level. This feature is fairly useful as it enables the visualization of the CFG of a function, thus providing a better overview of the control flow among the Basic Blocks (BBs). In many occasions, though, more information than that is needed in order to obtain quickly an adequate high level view of the execution of a function. One such desired attribute, that could lead to a better understanding, is the *execution frequency* of each Basic Block. We have developed our own LLVM analysis pass which makes use of the BB Frequency Info Analysis pass methods, as well as the profiling information gathered by the use of the llvm-profdata tool. Our analysis pass gathers the execution frequency of each BB in every function of an application. Subsequently, the other part of our toolchain, exploiting the default LLVM CFG printer, makes use of this data and assigns a specific colour to each BB in a CFG of a function. The colour scheme followed was inspired by a typical weather map, as it can bee seen in Figure 1. An example of the generated colour annotated CFG of a jpeg function can be seen in Figure 2. Our tool, ClrFreqCFGPrinter, can be applied in any benchmark and can be used to provide instant intuition regarding the execution frequency of BBs inside a function. A feature that can be useful for any developer or researcher working with the LLVM framework.

Fig. 1. Weather Map Temperature inspired colours to annotate the BBs according to their execution frequency.

References

[1] C. Lattner and V. Adve. LLVM: A Compilation Framework for Lifelong Program Analysis & Transformation. In *Proceedings of the 2nd International Symposium on Code generation and optimization*, page 75, Palo Alto, California, Mar. 2004.

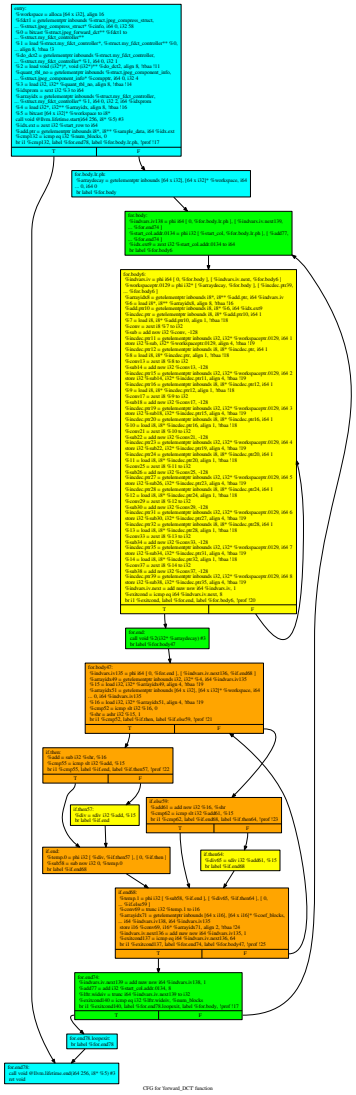

Fig. 2. Forward DCT function from Jpeg application. The BBs of the CFG are annotated with respect to their respective execution frequency.