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Award Abstract #1704117

SHF: Medium: Formal Methods for Program Fairness

NSF Org: [CCE](#)
[Division of Computing and Communication Foundations](#)

Initial Amendment Date: May 31, 2017

Latest Amendment Date: May 31, 2017

Award Number: 1704117

Award Instrument: Continuing grant

Program Manager: Nina Amla
CCF Division of Computing and Communication Foundations
CSE Direct For Computer & Info Scie & Enginr

Start Date: June 1, 2017

End Date: May 31, 2020 (Estimated)

Awarded Amount to Date: \$317,428.00

Investigator(s): Aws Albarghouthi aws@cs.wisc.edu (Principal Investigator)
Shuchi Chawla (Co-Principal Investigator)
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Sponsor: University of Wisconsin-Madison
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NSF Program(s): ALGORITHMIC FOUNDATIONS,
SOFTWARE & HARDWARE FOUNDATION

Program Reference Code(s): 7924, 7926, 8206

Program Element Code(s): 7796, 7798

ABSTRACT

As software permeates our personal lives, corporate world, and bureaucracy, more and more of our critical decisions are being delegated to opaque algorithms. These algorithms have thus become powerful arbitrators of a range of significant decisions with far-reaching societal impact. However, an algorithm carrying out a sensitive task could potentially discriminate ? advertently or inadvertently ? against certain groups. The overarching goal of this project is to enable automated reasoning about fairness of such decision-making programs. The results from this project are integrated in teaching curricula, thus raising awareness about fairness in automated decision making. The project trains graduate students in a unique and inter-disciplinary environment.

This project investigates various notions of fairness, inspired by the law and recent works in the area, and casts them through the formal lens of program verification. The project develops techniques for certifying that a program is fair under a given population, and techniques for automatically repairing unfair programs to make them fair. From a technical viewpoint, this project develops novel probabilistic program verification and synthesis technologies that, while focusing on the problem of fairness, are general and expand the reach of current technologies. Specifically, the project develops novel probabilistic verification techniques based on volume computation. Furthermore, the project develops program repair and debugging techniques for probabilistic programs.

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