Teaching Statement

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The candidate has redesigned the curriculum for ECE47300. The traditional AI curriculum is less relevant for today’s ECE undergraduates. AI is primarily a research enterprise. Most undergrads find training in AI of little relevance to their anticipated industrial career. Thus, the candidate has redesigned the curriculum for ECE47300 to focus on material that is relevant to preparing ECE undergrads for an industrial career. This includes styles of programming that are not covered in other ECE courses: functional programming and symbolic manipulation. Symbolic manipulation forms the basis of the automated reasoning techniques that are the algorithmic focus of ECE47300. Automated reasoning is used by microprocessor vendors for design verification.

In this redesigned course, many techniques and algorithms from AI are taught within the context of solving ECE problems, instead of traditional AI problems. For example, the concept of evaluation is taught by having the students write an evaluator for Boolean expressions, rather than an evaluator for LISP. The concept of rewrite systems is taught by having the students write a simplifier for Boolean expressions, rather than an expert system. The concept of resolution is taught by having the students write a system that uses resolution to find faults in a digital circuit rather than to prove theorems.

The redesigned course focuses on algorithms: evaluation, pattern matching and rewrite systems, constraint satisfaction, and automated reasoning techniques like semantic tableaux, resolution, and congruence closure. It is difficult for students to become fluent in these algorithms solely from the lectures. Thus, the problem sets have the students implement most of the algorithms taught in lecture.

Significant effort has gone into preparing the problem sets. It is not feasible for students to implement the material taught in lecture without a prepared infrastructure. There would simply be too much code to write over the course of a semester. Thus, the candidate has prepared a framework for each problem set that includes three components: (a) the low-level data-structure manipulation routines, (b) a search engine, and (c) a GUI that handles I/O and often animates the algorithm in operation. Within this framework, students need only implement the concept-rich portion of material taught in class. Having students write code that interoperates with a larger system teaches them how to read and understand APIs and write code that conforms to specifications. The candidate makes this course material available to other instructors, including ones at Georgia Tech and the University of Washington.

In 2010, the candidate redesigned the curriculum for ECE57000. As part of the revised course requirements, students do a term paper/project/presentation. Students select and read three papers published within the past three years in a conference or journal in AI, broadly construed to include AI, computer vision, natural-language processing, robotics, machine learning, and cognitive science. They then implement the ideas in one of them and write a six-page term paper in AAAI submission format, three pages of which present a review and critique of the three papers that they read and three pages of which describe their implementation and the experiments/evaluation that they performed. Upon completion, they present a 25-minute conference-style PowerPoint presentation to the class, half of which presents a review and critique of the three papers that they read and half of which discusses their implementation and evaluation. Inter alia, this has been used to satisfy the CS department Communication Requirement for MS students posted at https://www.cs.purdue.edu/graduate/curriculum/masters.html#communication.