Computational Analogy

Workshop at the
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Case-Based Reasoning
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Preface

Computational Analogy and Case-Based Reasoning (CBR) are closely related research areas. Both employ prior cases to reason in complex situations with incomplete information. Analogy research often focuses on modeling human cognitive processes, the structural alignment between a base/source and target, and adaptation/abstraction of the analogical source content. While CBR research also deals with alignment and adaptation, the field tends to focus more on retrieval, case-base maintenance, and pragmatic solutions to real-world problems. However, despite their obvious overlap in research goals and approaches, cross communication and collaboration between these areas has been progressively diminishing. Furthermore, there is disagreement within the Analogy research community on the role of representational structure. The objective of this workshop is to bring researchers who use a variety of analogical reasoning approaches together with researchers in CBR, to foster new collaborative endeavors, to stimulate new ideas and avoid reinventing old ones.

The workshop includes eleven papers drawn from across Computational Analogy research, with research relating to corpus mining for analogies, analogical proportions, analogy for natural-language processing, design by analogy, analogy tutors, and instruction for analogical agents. Four papers dealt with formal, or symbol-string, analogies, such as for machine translation. Langlais extended an off-line algorithm for identifying analogies in a corpus to scale to large datasets and used this system to predict the morphology of rare words. Fam & Lepage use formal analogy to predict unseen words, using information gathered from paradigm tables and tested on the New Testament, which has been translated into many languages. Kaveeta & Lepage present a neural-network model which, trained on a corpus, solves symbol-string analogical equations. And Letard, Illouz, & Rosset, working in the domain of translating natural language input to formal (bash scripts) commands, explore how reducing noise sensitivity can improve recall without reducing precision in solving formal analogies.

In performing design-by-analogy, it is helpful to have a system identifying similar designs from a database. Chan et al. use crowdsourcing to construct a dataset that contains signals which will guide machine learning models to match based on relations rather than surface features. Cvitanic et al. compare Latent Semantic Analysis and Latent Dirichlet Analysis to categorize patents into meaningful groups, for the purpose of scaling up search through a design database. Turner and Linsey show how abstracting design functions and flows can help identify similar designs in a database.

Badra presents a purely data-driven approach to case adapation, an important component of analogical and case-based reasoning. Blass & Forbus present a system that can use information presented in natural language to perform commonsense reasoning by analogy. Fitzgerald, Thomaz, & Goel discuss issues arising around abstraction for robotic agents learning through analogical generalization and acting through analogical transfer. Zeller & Schmid present an analogical tutor that builds a model of a student's misconceptions, then creates math problems designed to elucidate and overcome those misconceptions.

We believe these papers demonstrate both the continuing advances being made in analogy research, and the breadth of research topics for which computational analogy can and is used. We hope this workshop will both present an opportunity for analogy researchers to come together to learn about and discuss their work, as well as to discuss computational analogy with, and learn about other areas of CBR research from, the other participants at ICCBR. We would like to thank everyone who helped make this workshop a success, including the authors, program committee, and ICCBR-16 conference organizers.

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