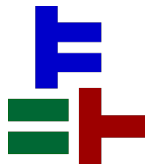# WG 5 Meeting 2024

David M. Cerna, Peter Koepke

Former: Cezary Kaliszyk

March 25th 2024

Working Group 5: Events

- ▶ AITP 2022 europroofnet.github.io/wg5-aitp22/

- ▶ Prague Workshop 2023 europroofnet.github.io/Prague23/
  - ▶ Practical Aspects of Machine Learning in Theorem Proving
  - ▶ Datasets Generation for Data-Deficient Domains

- ▶ Workshop on Natural Formal Mathematics
  europroofnet.github.io/cambridge-2023/
  - ▶ Joint WG4-WG5 meeting (Part of CICM 2023)

- ▶ Alignment of Proof Systems and Machine Learning
  europroofnet.github.io/wg5-vienna24/
  - ▶ As we speak.

- ▶ School on formalizations in (controlled) natural language
  - ▶ Current Plan: last year of EPN

STSM and ITC Grants

- STSM deadline: Just passed
- 3 recent STSMs associated with working group 5
  - https://europroofnet.github.io/accepted_stsms/
- Next ITC deadline: May 1st (age $\leq$ 40, Max. 2000 euros)
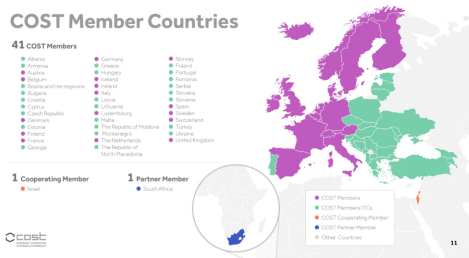
- 2 ITC Grants associated with working group 5 so far:
  - europroofnet.github.io/accepted_itcgs/

Work Group 5: Work

▶ The aim of this WG is to contribute to the field of machine-learning-based methods to improve the efficiency of automated theorem proving systems in terms of further development of techniques for proof guidance and premise selection. Furthemore, the group will explore how and to what extent tasks of computer-assisted reasoning can be extended to proofs that are represented in (controlled) natural languages.

▶ Regular WG meetings, organisation of topical workshops and tutorials as stand-alone events and/or as co-located events at major conferences, joint publications at high-quality scientific outlets, mutual lab visits, provision of free open-source software prototypes, curation of (or contribution to) online resources for teaching and public outreach.

Deliverable: First Completed

Learning Guided Automated Reasoning:
A Brief Survey

Lasse Blaauwbroek[1,2], David Cerna[3], Thibault Gauthier[1], Jan Jakubův[1,4],
Cezary Kaliszyk[4], Martin Suda[1], and Josef Urban[1]

[1] Czech Technical University in Prague
[2] Radboud University Nijmegen
[3] Czech Academy of Sciences Institute for Computer Science
[4] University of Innsbruck

Abstract. Automated theorem provers and formal proof assistants are
general reasoning systems that are in theory capable of proving arbitrar-
ily hard theorems, thus solving arbitrary problems reducible to math-
ematics and logical reasoning. In practice, such systems however face
large combinatorial explosion, and therefore include many heuristics and
choice points that considerably influence their performance. This is an
opportunity for trained machine learning predictors, which can guide the
work of such reasoning systems. Conversely, deductive search supported
by the notion of logically valid proof allows one to train machine learn-
ing systems on large reasoning corpora. Such bodies of proof are usually
correct by construction and when combined with more and more precise
trained guidance they can be bootstrapped into very large corpora, with
increasingly long reasoning chains and possibly novel proof ideas.
In this paper we provide an overview of several automated reasoning and
theorem proving domains and the learning and AI methods that have
been so far developed for them. These include premise selection, proof
guidance in several settings, AI systems and feedback loops iterating
between reasoning and learning, and symbolic classification problems.

▶ *D12 (or D8) - Detailed technical report on the evaluation of*
  techniques for learning proof search guidance and premise selection
  in automated theorem provers.
  europroofnet.github.io/publications/

Second Deliverable, Publications, Future Events

▶ **Deliverables:**

- White paper on including restricted natural language proof formats to existing proof libraries (Month 48).

▶ **Publications:**

- So far 120 publications associated with EPN europroofnet.github.io/publications/
- 14 are associated with Working Group 5. (rough count)

▶ **Events:**

- One event planned. We should have another event.
- Suggestions and initiative welcomed.