



## Seminar Hora Informaticae

Institute of Computer Science, Prague

Tuesday, February 4, 2025, **13.30 – 15.30 (1.30 – 3:30 PM)** CET

Meeting Room 318, Address: Pod Vodárenskou věží 2, Prague 8



Meeting ID: 914 0834 4018, Passcode: 668534

<https://cesnet.zoom.us/j/91408344018?pwd=x2QlZ4F42BxlMSmWc1HOwHHA7Uw7PN.1>

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**Yutaka Nagashima, Institute of Computer Science, Czech Academy of Sciences:**

### **Proof By Abduction in Isabelle/HOL.**

When proving an inductive problem, we often prove auxiliary lemmas that are useful for proving the original problem. If these auxiliary lemmas themselves are challenging, we must introduce more lemmas to prove these lemmas. To automate such multi-step conjecturing, we developed Abduction Prover. Given a proof goal, Abduction Prover conjectures a series of lemmas and attempts to prove the original goal using these lemmas. Our working prototype of Abduction Prover for Isabelle/HOL is publicly available on GitHub.

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### **References:**

- [1] Yutaka Nagashima. Definitional quantifiers realise semantic reasoning for proof by induction. In Laura Kovács and Karl Meinke, editors, Tests and Proofs - 16th International Conference, TAP 2022, Held as Part of STAF 2022, Nantes, France, July 5, 2022, Proceedings, volume 13361 of Lecture Notes in Computer Science, pages 48–66. Springer, 2022.
- [2] Yutaka Nagashima and Ramana Kumar. A proof strategy language and proof script generation for Isabelle/HOL. In Leonardo de Moura, editor, Automated Deduction - CADE 26 - 26th International Conference on Automated Deduction, Gothenburg, Sweden, August 6-11, 2017, Proceedings, volume 10395 of Lecture Notes in Computer Science, pages 528–545. Springer, 2017.
- [3] Yutaka Nagashima, Zijin Xu, Ningli Wang, Daniel Sebastian Goc, and James Bang. Template-based conjecturing for automated induction in Isabelle/HOL. In Hossein Hojjat and Erika Abraham, editors, 10th IPM International Conference on Fundamentals of Software Engineering, Conference Pre-Proceedings, pages 111–125. IPM, 2022.

**Yutaka Nagashima** (<https://yutakang.github.io/>) has mid-term research objective to achieve advanced proof automation by leveraging techniques from various fields and applying this automation to build trustworthy systems. I pursue this goal for both theoretical and practical reasons. On the theoretical side, theorem proving enables machines to fully capture the definitions of mathematical objects provided by users. On the practical side, theorem proving is becoming the standard for reliable systems programming. Researchers use theorem provers to define specifications and prove that their implementations meet these specifications. In the long run, I envision large-scale automation of scientific development through automated reasoning.

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**HORA INFORMATICAЕ** (meaning: TIME FOR INFORMATICS) is a broad-spectrum scientific seminar devoted to all core areas of computer science and its interdisciplinary interfaces with other sciences and applied domains. Original contributions addressing classical and emerging topics are welcome. Founded by Jiří Wiedermann, the seminar is running since 1994 at the Institute of Computer Science of the Czech Academy of Sciences in Prague.

<https://www.cs.cas.cz/horainf>