Towards a Geometry Automated Provers Competition

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Automated Deduction in Geometry

The geometry automated theorem provers (GATP) distinguish themselves for the many different approaches and implementations available.

- Synthetic Methods — AI methods (from the 50s/60s), new methods tailored to specific set of problems.
- Algebraic Methods — Wu's Method, Gröbner Basis Method, etc.
- Coordinate-free Methods (semi-synthetic) — Area Method, Full-angle method, etc.
- Logic Methods — Resolution Method, Coherent Logic, etc.

Many areas of application from research in the area of artificial intelligence to applications in education.

GATP — Measuring Efficiency

Apart the usual measures of efficiency:

- CPU execution time — in a classroom a time threshold of 3s as to be considered [8].
- RAM space — not important in current methods (up to the moment it is, given the combinatorial explosion).

Geometric proofs: the possibility of natural language and/or visual renderings is desirable and possible.

- Algebraic/Logic Methods — only a yes/no answer — can be useful when only a question of validation is requested.
- Synthetic/Coordinate-free methods/Coherent Logic — natural language/visual renderings are possible — the possibility of having the proof as object of study.

Towards a Geometry Automated Provers Competition

The implementation of a competition between GATP would allow to create a test-bench for GATP developers to improve the existing ones and/or to propose new ones.

It would also allow to establish a ranking for GATP tailored to different “clients” (e.g. developers of educational e-learning systems).

Repositories of Geometric Problems

Towards a Geometry Automated Provers Systems Competition (GASC)

A first repository of problems:

TGTP Thousands of Geometric problems for geometric Theorem Provers is a Web-based repository of problems in geometry, with a significant size it provides also a supporting library to allow the use of the repository by different GATP [5].

Geometry Automated Theorem Provers Systems

GASC — Current implementations of GATPs.

GCLC Geometry Constructions → LaTeX Converter implements the Area Method, the Wu's method and the Gröbner Basis method [2].

OpenGeoProver Open Library of Geometry Automatic Theorem Provers(OGP), implements the Wu's method (work is being done in implementing the area method and the full-angle method).

CoqAM The formalisation of the area method using the proof assistant Coq [4].

GeoGebra's Portfolio Prover has an embedded prover system that is capable of using multiple internal backends for proving theorems: Recio's exact check method, the Gröbner Basis Method, OGP [1, 3].

Towards a Geometry Automatic Theorem Provers Systems Competition

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3. Script to show the results as soon as they are available — `./results_gasc.sh`, infinite loop, 5s refresh cycle.

GASC — Results

	Success	Failure
GCLC_AM	64	74
GCLC_GBM	89	49
GCLC_WM	126	97
GeoGebra_RM	40	97
GeoGebra_BM	40	97

Problem	Prover	Result
GEO0322	GCLC (AM)	Failure - Time limit exceeded
GEO0322	GCLC (GBM)	Success - 1493
GEO0322	GG (TM)	Not applicable
GEO0322	GG (BM)	Not applicable
GEO0322	GCLC (WM)	Success - 2
GEO0323	GCLC (AM)	Success - 0
GEO0323	GCLC (GBM)	Success - 0
GEO0323	GCLC (WM)	Success - 0
GEO0323	GG (TM)	Success - 22
GEO0323	GG (BM)	Success - 416
GEO0324	GCLC (AM)	Failure - Out of scope
GEO0324	GCLC (GBM)	Success - 2
GEO0324	GCLC (WM)	Success - 0
GEO0321	GG (TM)	Success - 330

Conclusions & Future Work

- In 2019 — GASC 0.1 — ☺

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GASC — each year at ThEdu | each two years at ADG | ...

Thank You / Obrigado

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