Reconstructing Propositional Proofs in Type Theory
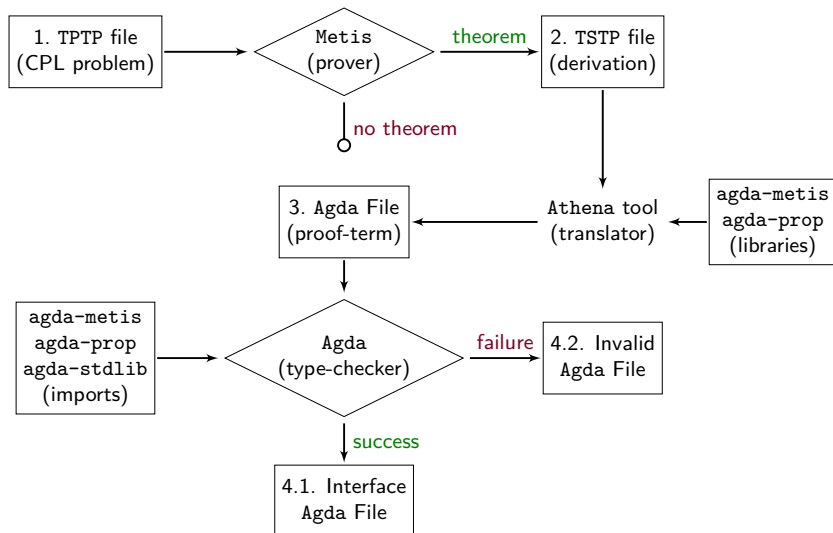
Jonathan Prieto-Cubides
Advisor: Andrés Sicard-Ramírez

Master in Applied Mathematics
Universidad EAFIT
Medellín, Colombia

November 15, 2017

UNIVERSIDAD
EAFIT®

Metis is an automatic theorem prover for first-order logic with equality developed by **hurd2003first** [**hurd2003first**]. For the propositional fragment, Metis has only three inference rules:

$$\frac{}{\Gamma \vdash \varphi} \text{ axiom}$$

$$\frac{}{\Gamma \vdash \varphi \vee \neg\varphi} \text{ assume } \varphi$$

$$\frac{\Gamma \vdash l \vee \varphi \qquad \Gamma \vdash \neg l \vee \psi}{\Gamma \vdash \varphi \vee \psi} \text{ resolve } l$$

Where Γ is a set of premises, and $\_ \vdash \_$ is the syntactical consequence relation between the premises on the right, and the conclusion on the left.

- ▶ Open source implemented in Standard ML
- ▶ Each refutation step is one of *six rules*
- ▶ Reads problem in TPTP format
- ▶ Outputs *detailed* proofs in TSTP format

TSTP derivations by `Metis` exhibit the following inferences:

`Metis` **rule**	**Purpose**
`strip`	Strip a goal into subgoals
`conjunct`	Takes a formula from a conjunction
`resolve`	A general form of the resolution theorem
`canonicalize`	Normalization of the formula
`clausify`	Performs clausification
`simplify`	Simplify definitions and theorems