Towards Logical Syntactic Structures as Graphs

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1. Logical grammar reduces grammaticality to provability in a categorial logic.

2. Consequently, a) Parsing is deduction; and b) Syntactic structures/parse structures are proofs.
3. But what is a proof?

4. E.g. sequent proofs are not enough:
5. Girard’s proof nets are a good answer.

6. These are graphs which must satisfy certain global and local properties to be correct as proofs (proof nets).
7. But in many cases we don’t know how to define proof nets, e.g. our current categorial logic contains 62 connectives.

8. An intermediate answer is Andreoli’s focalisation.
9. In focalisation situated (\(\bullet/\circ\)) connectives are classified as of negative (asynchronous) or positive (synchronous) polarity according as their rule is reversible or not.

10. There are alternating phases of don’t-care nondeterministic negative rule application, and positive rule application locking on to focalised formulas.

\[
\begin{align*}
N, \boxed{(N\backslash S)/N}, N \Rightarrow S \\
\quad (N\backslash S)/N, N \Rightarrow N\backslash S & \quad S \Rightarrow S \\
\quad CN \Rightarrow CN & \quad S/(N\backslash S), N\backslash S \Rightarrow S \\
\quad S/(N\backslash S), (N\backslash S)/N, N \Rightarrow S & \quad /L \\
\quad (S/(N\backslash S)))/(CN), CN, \boxed{N\backslash S} \Rightarrow S & \quad */L \\
\quad (S/(N\backslash S))/CN, CN, \boxed{(N\backslash S)/N}, N \Rightarrow S & \quad /L
\end{align*}
\]
11. Focalisation does not provide the complete answer to the question “What is a proof/syntactic structure?”, but it does facilitate efficient parsing/theorem-proving.

12. We are developing the categorial logic parser/theorem-prover CatLog using focalisation.
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