Linearity Paper Final Version Revision

May 22, 2018

------------------- Review 1 -------------------

PAPER: 3
TITLE: On the Lambek Calculus with an Exchange Modality AUTHORS: Jiaming Jiang, Harley Eades Iii and Valeria de Paiva
Overall evaluation: 1 (weak accept)
----------- Overall evaluation -----------
This paper introduces a type system for (non-symmetric) monoidal adjunctions between a symmetric monoidal closed category and a monoidal bi-closed category called CNC logic. It can be considered as a variant of Benton's LNL logic for symmetric monoidal adjunctions between a cartesian closed category and a symmetric monoidal closed category.

This paper is in general clearly written and should be easy to follow for readers familiar with the categorical models of linear logic. I did not check the detail
of CNC logic (largely because there is no information on its equational or rewriting theory). However, since it is based on well-established categorical structures, I believe that there should be no substantial errors.

My knowledge on the Lambek Calculus is rather limited, but I think that having a good categorical semantics and type system for Lambek Calculus should be useful and makes a good case of technology-transfer from Linear Logic to the Lambek Calculus. Thus I recommend acceptance.

- Lemma 7:
  I think that this result was already in Kock's 1970 original paper.
- Corollary 11:
  I think that the statement of this corollary is wrong. As Benton (and many other people) points out, the category of coalgebras of a linear exponential comonad on a symmetric monoidal closed category does not have to be cartesian closed (and we should take some subcategory instead). The same applies to the setting of this paper.
- Theorem 18:
  I am not sure what "a complete moel" means - completeness w.r.t. derivablity or w.r.t. equational theory? (It seems that the same question applies to
  [8].)
- Section 4:
  I agree that the Dialectica categories developped here are interesting,
  but also wonder if some much easier models could also do the good job without
  much technical complication.
  For instance, starting with a strong monoidal functor F:C->D from a symmetric monoidal category C to a monoidal category D, the monoidal cocompletion (i.e. taking the presheaf categories) immediately gives an LAM [C^op,Set] -> [D^op.Set], thus
  a sound model of CNC logic.
- A work which might be related to this paper is
  Masahito Hasegawa:

Linear Exponential Comonads without Symmetry. LINEARITY 2016: 54-63

where the author axiomatizes comonads corresponding to monoidal adjunctions between a cartesian category and a monoidal category. It might be interesting

to do the same for LAM (which should be something like "linear exchange comonads").

- On the direction of arrows:

  It seems that the direction of arrow types is not in harmony with the standard Lambek Calculus nor with the usual convention for internal homs in monoidal bi-closed categories. Is there any reason for this choice?

Response to Review 1:

- Will add the reference by Hasegawa.
- Lemma 7

  Only found half of it is in Kock's 1970 paper. The full if and only if version is in Kock's 1972 paper.

  As said at the beginning of the 1972 paper: "In [4] (i.e., *Monads on Symmetric Monoidal Closed Categories*) we proved that a commutative monad on a symmetric monoidal closed category carries the structure of a symmetric monoidal monad ([4], Theorem 3.2). We here prove the converse, so that, taken together, we have: there is a 1-1 correspondence between commutative monads and symmetric monoidal monads (Theorem 2.3 below)."

  Have added the reference and changed the citation for Lemma 7.

- Corollary 11

  The reviewer thought we were trying to prove that it is cartesian closed.

  The reviewer writes "As Benton (and many other people) points out, the category of coalgebras of a linear exponential comonad on a symmetric monoidal closed category does not have to be cartesian closed (and we should take some subcategory instead)."

  Didn't change anything

- Theorem 18

  The reviewer is not sure what "complete" means.

  Added "(w.r.t. derivability and quational theory)"

- Direction of Arrows

  Not sure why the reviewer thinks the direction of arrows is wrong. Wikipedia on closed monoidal category uses $\Rightarrow$ for right adjoint and $\Leftarrow$ for left adjoint. The original Lambek paper uses \ and /. The page on closed monoidal cateogry in nLab (https://ncatlab.org/nlab/show/closed+monoidal+category) uses square brackets, i.e., $[b, c]$ for $b \Rightarrow c$.

  Didn't change anything

--------------------- Review 2 ---------------------

PAPER: 3
TITLE: On the Lambek Calculus with an Exchange Modality AUTHORS: Jiaming Jiang, Harley Eades Iii and Valeria de Paiva
Overall evaluation: 2 (accept)
----------- Overall evaluation -----------
The paper seems as a good contribution to the development of the research in Lambek Calculus and its extensions and in Non Commutative Linear Logic. The results seem accurate and well presented. The authors have a very good

experience in this field. It would be interesting to compare this work with Non Commutative Logic introduced by Abrusci and Ruet.

Response to Review 2

- Reference by Abrusci and Ruet:
  Will add the reference.