Alexis TOUMI

alexis.toumi.xyz alexis@toumi.email 127 avenue Jean Jaurès, 75019 Paris, France

WORK EXPERIENCE

Oct 2022 – **Post-doctoral researcher**, *Laboratoire d'Informatique & Systèmes*, Marseille
Formal methods for quantum cellular automata and distributed quantum computing.
Principal investigators: Prof. Giuseppe di Molfetta and Dr. Pierre Clairambault

2019 – **Part-time scientific advisor**, *Cambridge Quantum Computing*, Oxford
Natural language processing on noisy intermediate-scale quantum hardware.
Applied category theory for quantum computing and artificial intelligence.

May–Jul 2022 **General Manager**, *Le Lab Quantique*, Paris
Administration of a French nonprofit that promotes the emergence of quantum technologies.

2017 – 2018 **Data Scientist**, *IRHT (CNRS) & Teklia*, Paris
Deep learning for the automated analysis of manuscripts from the Middle Ages.

2015 – 2016 **Machine Learning Intern**, *Tinyclues*, Paris
Tensor factorisation on complex relational data: users, products, emails, clicks and sales.

2014 – 2015 **Data Science Intern**, *Yonderlabs*, Berlin
Probabilistic graphical models for natural language processing and sentiment analysis.

EDUCATION

2018 – 2022 **D.Phil. Computer Science**, University of Oxford
"Category Theory for Quantum Natural Language Processing" [arXiv]
Supervisors: Prof. Bob Coecke and Dr. Dan Marsden, *Defended on:* May 27th, 2022.
Examiners: Prof. Sam Staton (internal) and Prof. Dr. Michael Moortgat (Utrecht University)

2016 – 2018 **M.Sc. Mathematics & Computer Science**, *distinction*, University of Oxford
"Categorical Compositional Distributional Questions, Answers & Discourse Analysis" [pdf]
Supervisor: Prof. Bob Coecke

2012 – 2015 **B.Sc. Computer Science**, *first-class honours*, University of Oxford
"Equilibrium Checking in Reactive Modules Games" [pdf]
Supervisors: Prof. Michael Wooldridge and Dr. Julian Gutierrez

2012 **Option Internationale du Baccalauréat**, *série scientifique, mention très bien*, British section, Lycée International de Saint-Germain-en-Laye

SCHOLARSHIPS

2018 **Oxford – DeepMind Graduate Scholarship in Computer Science**

2018 **Wolfson Harrison UK Research Council Quantum Foundation Scholarship**

2013 **University of Oxford, New College Academic Scholarship**

TEACHING

2019 **Quantum Computer Science**, *M.Sc.*, University of Oxford *(class tutor)*

2019 **Logic & Proof**, *B.Sc.*, University of Oxford *(class tutor)*

2019 **Computational Complexity**, *B.Sc.*, St Anne's College *(private tutor)*

2018 **Computational Complexity**, *B.Sc.*, University of Oxford *(class tutor)*

2018 **Data Science with Python**, *Master 1*, ESILV Paris *(chargé de TD)*

SOFTWARE

DisCoPy The Python toolkit for computing with string diagrams *(main developer)*

lambeq A Python library for experimental quantum natural language processing *(advisor)*

PUBLICATIONS

Preprints

2021 **lambeq: An Efficient High-Level Python Library for Quantum NLP** [arXiv]
with D. Kartsaklis, I. Fan, R. Yeung, A. Pearson, R. Lorenz, G. de Felice, K. Meichanetzidis, S. Clark and B. Coecke.

2020 **Foundations for near-term quantum natural language processing** [arXiv]
with B. Coecke, G. de Felice and K. Meichanetzidis.

2020 **Grammar-aware question-answering on quantum computers** [arXiv]
with K. Meichanetzidis, G. de Felice and B. Coecke.

Journal articles

2018 **Generalized relations in linguistics & cognition** [DOI]
with B. Coecke, F. Genovese, M. Lewis and D. Marsden.
Theoretical Computer Science, volume 752, pages 104-115

Book chapters

2021 **How to make qubits speak** [arXiv]
with B. Coecke, G. Felice and K. Meichanetzidis.
Quantum Computing in the Arts and Humanities, pages 277-297

Conference proceedings

2021 **Diagrammatic Differentiation for Quantum Machine Learning** [arXiv]
with R. Yeung and G. de Felice.
18th International Conference on Quantum Physics and Logic (QPL 2021)

2020 **Quantum natural language processing on near-term quantum computers** [arXiv]
with K. Meichanetzidis, S. Gogioso, G. De Felice, N. Chiappori and B. Coecke.
17th International Conference on Quantum Physics and Logic (QPL 2020)

2020 **DisCoPy: monoidal categories in Python** [arXiv]
with G. De Felice and B. Coecke.
3rd International Conference on Applied Category Theory (ACT 2020)

2020 **Functorial language games for question answering** [arXiv]
with G. de Felice, E. Di Lavore and M. Román.
3rd International Conference on Applied Category Theory (ACT 2020)

2019 **Functorial question answering** [arXiv]
with G. de Felice and K. Meichanetzidis.
2nd International Conference on Applied Category Theory (ACT 2019)

2019 **Automatic page classification in a large collection of manuscripts based on the International Image Interoperability Framework** [DOI]
with E. Boros, E. Rouchet, B. Abadie, D. Stutzmann and C. Kermorvant.
International Conference on Document Analysis and Recognition (ICDAR 2019)

2018 **Towards compositional distributional discourse analysis** [arXiv]
with B. Coecke, G. de Felice and D. Marsden.
Compositional Approaches for Physics, NLP, and Social Sciences (CAPNS 2018)

2016 **Rational verification: From model checking to equilibrium checking** [DOI]
with M. Wooldridge, J. Gutierrez, P. Harrenstein, E. Marchioni and G. Perelli.
Thirtieth AAAI Conference on Artificial Intelligence (AAAI 2016)

2015 **A tool for the automated verification of Nash equilibria in concurrent games** [DOI]
with J. Gutierrez and M. Wooldridge.
12th International Colloquium on Theoretical Aspects of Computing (ICTAC 2015)

Conference abstracts

2022 **DisCoPy for the quantum computer scientist** [arXiv]
with G. de Felice and R. Yeung.
19th International Conference on Quantum Physics and Logic (QPL 2022)

2022 **Quantum NLP with lambeq** [pdf]
with D. Kartsaklis, I. Fan, R. Yeung, T. Hoffmann, V. Kocijan, C. London, A. Pearson, R. Lorenz, G. de Felice, K. Meichanetzidis, S. Clark and B. Coecke.
5th International Conference on Applied Category Theory (ACT2022)

2021 **QNLP: Compositional Models of Meaning on a Quantum Computer** [pdf]
with K. Meichanetzidis, R. Lorenz, A. Pearson, G. de Felice, D. Kartsaklis and B. Coecke.
4th International Conference on Applied Category Theory (ACT 2021)

2021 **Anaphora and Ellipsis in Lambek Calculus with a Relevant Modality: Syntax and Semantics** [arXiv]
with L. McPheat, G. Wijnholds, M. Sadrzadeh and A. Correia.
4th International Conference on Applied Category Theory (ACT 2021)

2021 **Functorial Language Models** [arXiv]
with A. Koziell-Pipe.
4th International Conference on Applied Category Theory (ACT 2021)

2020 **Quantum natural language processing** [pdf]
with K. Meichanetzidis, S. Gogioso, G. De Felice, N. Chiappori and B. Coecke.
3rd International Conference on Applied Category Theory (ACT 2020)

2019 **Incremental Monoidal Grammars** [arXiv]
with D. Shiebler and M. Sadrzadeh.
Sixth Symposium on Compositional Structures (SYCO 6)

2019 **Discourse complexity in categorical compositional relational semantics** [pdf]
Vector Semantics for Dialogue and Discourse (VSDD) workshop
13th International Conference on Computational Semantics (IWCS 2019)

TALKS

Invited lectures

TallCat, 2021 **Categories for Linguistics** [notes], *with Giovanni de Felice*

TallCat, 2021 **Categories for Quantum** [notes], *with Giovanni de Felice*

Software demonstrations

QNLP 2022 **DisCoPy: Distributional Compositional Python** [video]
PyData 2020 **Language Processing on Quantum Hardware** [video]
QNLP 2020 **QNLP implementations** [video], *with Konstantinos Meichanetzidis*
QNLP 2019 **Towards NLP on Quantum Hardware** [video]

Conference presentations

QPL 2021 **Diagrammatic Differentiation for Quantum Machine Learning** [video]
ACT 2020 **DisCoPy: monoidal categories in Python** [video]
ACT 2019 **Functorial question answering**
IWCS 2019 **Discourse complexity in categorical compositional relational semantics**
CAPNS 2018 **Towards compositional distributional discourse analysis** [video]
ICTAC 2015 **A tool for the automated verification of Nash equilibria in concurrent games**

Seminars

2022 **Category theory for quantum natural language processing** [slides]
LIS, Marseille
JIQ, Paris
QuaCS, Gif-sur-Yvette
Quandela, Massy
Quantinuum, Cambridge
UCL, London

2019 **Sheaf-theoretic decision problems**, *review of a preprint by D. Mazza* [pdf]
Samson Abramsky's Sheaf Lunch, Oxford

2018 **Functorial translation from natural language to database queries**
Samson Abramsky's Sheaf Lunch, Oxford

2018 **From Sentence to Discourse in DisCoCat**
Quantum Lunch, Oxford

Summer schools

ACT 2019 **Meeting the Dialogue Challenge** [post], *with Dan Shiebler*
L'agape 2017 **Quantum structures in cognition and natural language**

DIFFUSION & SCIENTIFIC MEDIATION

Blog posts

2022 **What are quantum computers good for?** [post], published by Le Lab Quantique

2021 **Quantum Natural Language Processing II** [post], *with Dimitri Kartsaklis, Ian Fan, Richie Yeung, Anna Pearson, Robin Lorenz, Giovanni de Felice, Konstantinos Meichanetzidis, Stephen Clark and Bob Coecke*

2020 **Quantum Natural Language Processing** [post], *with Bob Coecke, Giovanni de Felice and Konstantinos Meichanetzidis*

Hackathons

I supervised teams of students working on the following projects.

2022 **QNLP for adverse event detection in the healthcare industry** [abstract], Technical University of Munich and IT Healthcare Innovation Incubator, Merck KGaA

2021 **QNLP for sentiment analysis** [GitHub], Qiskit Hackathon Europe

2021 **Discovering QNLP through DisCoPy**, BIG Quantum Hackathon by QuantX

Wikis

Wikipedia *Creator:* DisCoCat, QNLP, *Editor:* String diagram, Categorical quantum mechanics

nLab *Creator:* pregroup grammar, dependency grammar, *Editor:* DisCoCat, linguistics

LANGUAGES

Human Native French, fluent English, basic German and beginner Arabic.

Machine *Advanced:* Python, LaTeX, Markdown, HTML. *Basic:* Javascript, Haskell, SQL, C.

OTHER INTERESTS

Philosophy Spinoza, Peirce, Bergson, Wittgenstein, Foucault, Deleuze.

Cooking French, Moroccan, Italian, Spanish, Kréol Rényoné.

Music 10 years of DJing, both digital and analog. Techno, Disco, Funk, Afrobeat, Maloya.