CV | Benjamin **Bergougnoux**

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Academic positions

Post-doc

Bergen, Norway

University of Bergen

Since September 2019

- 3 years position in the **Algorithm** group.
- **Supervisor:** Jan Arne Telle.

Assistant Professor

Paris, France

Université Paris Diderot

2018 - 2019

- Position of 10 months with reasearch duty and 158 hours of teaching duty.
- **Laboratory:** IRIF.
- **Team:** Theory and algorithmics of graphs.

Degree

PhD in Computer Science

Clermont-Ferrand, France

Université Clermont Auvergne

Defended on the 13/02/2019

- **Laboratory:** LIMOS.
- **Supervisors:** Mamadou M. Kanté.
- **Description:** The objectives of my thesis is to characterize the structural restrictions on (hyper)graphs that make NP-hard problems tractable. For doing so, I studied structural parameters that are more general than tree-width such as clique-width and rank-width.

Master in Computer Science

Montpellier, France

Université de Montpellier

2013 - 2015

- **Specialization:** Theoretical Computer Science, Algorithmic, Complexity, Optimization.
- **Master Thesis:** Supervised by Cristophe Paul and Philippe Janssen.
  Parameterized Complexity and Kenerlization for Constraint Satisfaction Problem.

Bachelor in Mathematics

Montpellier, France

Université de Montpellier

2010 - 2013

- **Specialization:** *Algebra and Computer Science.*

Publications

[1] A new notion of Representative Sets for Graph Coloring

B. Bergougnoux ∗ In preparation 2022

[2] A Logic-Based Algorithmic Meta-Theorem for Mim-Width

B. Bergougnoux, J. Dreier, L. Jaffke. ∗ Submitted 2022 ∗ Open access link

[3] Recognition of Linear and Star Variants of Leaf Powers is in P

B. Bergougnoux, S. Høgemo, M. Vatchelle, J. A. Telle. ∗ Submitted 2022 ∗ Open access link

[4] On Dasgupta's hierarchical clustering objective and its relation to other graph parameters

S. Høgemo, B. Bergougnoux, U. Brandes, C. Paul, J. A. Telle. ∗ Conference: FCT 2021 ∗ Open access link

[5] Close relatives of Feedback Vertex Set without single-exponential algorithms parameterized by treewidth

B. Bergougnoux, É. Bonnet, N. Brettell, O. Kwon. ∗ Conference: IPEC 2020 ∗ Open access link

[6] Node Multiway Cut and Subset Feedback Vertex Set on graphs of bounded mim-width

B. Bergougnoux, C. Papadopoulos, J. A. Telle. ∗ Conference: WG 2020, Journal: Algorithmica 2022 ∗ Open access link

[7] More applications of the d-neihgbor equivalence: acyclicity and connectivity constraints

B. Bergougnoux, M. M. Kanté. * Conference: ESA 2019, Journal: SIDMA 2021 * Open access link

[8] Disjunctive minimal separators enumeration

B. Bergougnoux, M. M. Kanté, Kunihiro Wasa. * Workshop: WEPA 2019 * Open access link

[9] Counting minimal transversals of β-acyclic hypergraphs

B. Bergougnoux, F. Capelli, M. M. Kanté. * Journal: JCSS 2019 * Open access link

[10] Fast exact algorithms for some connectivity problems parameterized by clique-width

B. Bergougnoux, M. M. Kanté. * Journal: TCS 2019 * Open access link

[11] On minimum connecting transition sets in graphs

T. Bellitto, B. Bergougnoux. * Conference: WG 2018 * Open access link

[12] An optimal XP algorithm for Hamiltonian cycle on graphs of bounded clique-width

B. Bergougnoux, M. M. Kanté, O. Kwon. * Conference: WADS 2017, Journal: Algorithmica 2020 * Open access link

[13] Towards a polynomial kernel for directed feedback vertex set

B. Bergougnoux, E. Eiben, R. Ganian, S. Ordyniak, M. S. Ramanujan. * Conference: MFCS 2017, Journal: Algorithmica 2021 * Open access link

Best papers

[7] More applications of the d-neihgbor equivalence: acyclicity and connectivity constraints

B. Bergougnoux, M. M. Kanté. * Conference: ESA 2019, Journal: SIDMA 2021 * Open access link

Abstract: In this paper, we design a framework to obtain efficient algorithms for several problems with a global constraint (acyclicity or connectivity) such as Connected Dominating Set, Node Weighted Steiner Tree, Maximum Induced Tree, Longest Induced Path, and Feedback Vertex Set. We design a meta-algorithm that solves all these problems and whose running time is upper bounded by $2^{O(k)} \cdot n^{O(1)}$, $2^{O(k^2)} \cdot n^{O(1)}$ and $n^{O(k)}$ where k is respectively the clique-width, rank-width and maximum induced matching width of a given decomposition. Our approach simplifies and unifies the known algorithms for each of the parameters and its running time matches asymptotically also the running times of the best known algorithms for basic NP-hard problems such as Vertex Cover and Dominating Set. Our framework is based on the d-neighbor equivalence defined in [Bui-Xuan, Telle and Vatshelle, TCS 2013] and the rank-based approach introduced in [Bodlaender, Cygan, Kratsch and Nederlof, ICALP 2013]. The results we obtain highlight the importance of the d-neighbor equivalence relation on the algorithmic applications of width measures.

We also prove that our framework could be useful for W[1]-hard problems parameterized by clique-width such as Max Cut and Maximum Minimal Cut. For these latter problems, we obtain $n^{O(k)}$, $n^{O(k)}$ and $n^{2^{O(k)}}$ time algorithms where k is respectively the clique-width, the rank-width of the input graph.

[2] A Logic-Based Algorithmic Meta-Theorem for Mim-Width

B. Bergougnoux, J. Dreier, L. Jaffke. * Submitted in 2022. * Open access link

Abstract: We introduce a logic called *distance neighborhood logic with acyclicity and connectivity constraints* (A&C DN for short) which extends existential MSO_1 with predicates for querying neighborhoods of vertex sets and for verifying connectivity and acyclicity of vertex sets in various powers of a graph. Building upon [Bergougnoux and Kanté, ESA 2019; SIDMA 2021], we show that the model checking problem for every fixed A&C DN formula is solvable in $n^{O(w)}$ time when the input graph is given together with a branch decomposition of mim-width w. Nearly all problems that are known to be solvable in polynomial time given a branch decomposition of constant mim-width can be expressed in this framework. We add several natural problems to this list, including problems asking for diverse sets of solutions.

Our model checking algorithm is efficient whenever the given branch decomposition of the input graph has small index in terms of the *d-neighborhood equivalence* [Bui-Xuan, Telle, and Vatshelle, TCS 2013]. We therefore unify and extend known algorithms for tree-width, clique-width and rank-width. Our algorithm has a single-exponential dependence on these three width measures and asymptotically matches run times of the fastest known algorithms for several problems. This results in algorithms with tight run times under the Exponential Time Hypothesis (ETH) for tree-width and clique-width; the above mentioned run time for mim-width is nearly tight under the ETH for several problems as well. Our results are also tight in terms of the expressive power of the logic: we show that already slight extensions of our logic make the model checking problem para-NP-hard when parameterized by mim-width plus formula length.

Invited Talks

What follows is a list of presentations I have given as an invited speaker.

- GRAA, french virtual seminar of graph theory and combinatorics, January 2022
- IPEC, online conference, December 2020
- WG, online conference, June 2020
- ESA, Munich (Germany), September 2019
- IBS Summer Research Program on Algorithms and Complexity in Discrete Structures (South Korea), July 2019
- University of Bergen (Norway), March 2019
- International symposium of Basic Sciences at INU (South Korea), October 2018
- JGA, french workshop on graphs and algorithms, Grenoble, November 2018
- INRIA Lille (France), team LINKS, March 2017
- JGA, french workshop on graphs and algorithms, Bordeaux, November 2017
- Université de Bordeaux (France), LABRI, September 2017
- JGA, french workshop on graphs and algorithms, November 2016
- TU Wien, Algorithms and Complexity Group, Vienna (Austria), September 2016

Teaching

I gave 158 hours of teaching during my ATER position and 192 hours during my PhD. In the following, CM means lecture, TD means tutorial and TP means practical work.

Université Paris Diderot			*Paris, France*
C language: Pointers, data structures, function pointers.	3rd year	60h TP	*2018 - 2019*
Programming Project: Elaboration and follow-up of projets.	2nd year	24h TD	
Object-oriented programming advanced: Inheritance, multithreading, JavaFx.	3rd year	20h TP	
System programming: Fork, I/O, file system, lock, pipe, mmap, semaphors.	4th year	24h TP	
Web programming: Html, PHP, MySQL, jQuery, Node.js, Ajax, Bootstrap, Symphony.	3rd year	30h TP	

Université Clermont Auvergne			*Clermont-Ferrand, France*
Algorithmic Introduction: Variable, array, list.	1st year	30h TD	*2017 - 2018*
Graph Theory: Fundamental Algorithm, Kruskal, Dijkstra.	3rd year	18h TP	
Operating System: Garbage collector, process management , shell.	3rd year	16h TP	
Projet Supervisor: AI for a cooperative game called Hanabi	4th year		
IT tools: Spreadsheet, word processor and presentation program.	1st year	12h TP	*2016 - 2017*
Network: TCP / UDP, security, cryptography	3rd year	8h TD	
Operating System: System call, memory / process management.	1st year	12h CM, 16h TD, 16h TP	
OCaml programming: Basis of programing and algorithmic.	1st year	64h TP	*2015 - 2016*

Collective responsibilities

APGA 2022: Advances in Parameterized Graph Algorithms *May 2022*

Member of the organization commitee, in charge of the website.

University of Bergen *2019-2022*

Member of four commitees for evaluating PhD students intermediary lectures

The Parameterized Complexity Newsletter. *Since 2019*

Co-editor of the newsletter.

Reviewer *Since 2018*

29 reviews for 19 journals and conferences (e.g. JCTB, TALG, STACS, ICALP).

LIMOS *2017 - 2018*

Member of the laboratory council.

ANR projet: GraphEn (Graph Enumeration) *2016 - 2018*

Member of the ANR projet and webmaster.

WEPA 2016: First Workshop on Enumeration Problems and Applications *November 2016*

Member of the organization commitee.