um ÉCOLE POLYTECHNIQUE UNIVERSITÉ PARIS-SACLAY

INTERNSHIP PROGRAM FOR INTERNATIONAL STUDENTS

INTERNSHIP SUBJECT FORM

Name of the Host Laboratory	Centre de Mathématiques Appliquées
Website of the Host Laboratory	
Research Group	SIMPAS
Internship Supervisor	Eric MOULINES
Internship Subject	Transportation cost information inequality with application to Langevin dynamics.
Student's level	☐ Advanced Undergraduate Students (3rd or 4th year) ☒ Master's students (1st or 2nd year) ☐ PhD students
Proposed Duration	☒ 3 months ☐ 4 months ☐ 5 months ☐ 6 months
Prerequisites	
Internship description (max. 15 lines)	The Hanson wright inequality asserts that if $X_1,\dots,X_n$ are independent mean zero, random variables with sub-Gaussian tail decay, i.e. for all $t>0$, $\mathrm{P}(\lvert X_i\rvert>t)\le 2\exp(-t^2/K^2)$, and $A=[a_{ij}]$ is an $n\times n$ matrix, then the quadratic form $Z=\sum_{i,j=1}^{n} a_{ij}Z_iZ_j$ satisfies the inequality $$\mathrm{P}(\lvert Z-\mathrm{tr}(A)\rvert>t)\le 2\exp(-2/CK^2\min(t^2/\lVert A\rVert_{\mathrm{HS}}\lVert \mathrm{Cov}(X)\rVert, t/\lVert A\rVert)$$ Hanson-Wright inequality plays a key role in Machine Learning, to deal with empirical risk minimization when additive functionals are replaced by quadratic functionals. It has recently been established by Adamczak (2015) that the concentration inequality for all Lipschitz functions implies a uniform version of the Hanson-Wright inequality for suprema of quadratic forms (in the spirit of the inequalities by Arcones-Giné and Ledoux-Talagrand). The objective of this internship is to find conditions upon which the Unadjusted Langevin Algorithm satisfies this concentration inequality. We will in particular investigate the use of transportation cost to address this problem, using results of Guillin, Djellout and Wu (2004).
