الجمهورية الجزائرية الديمقراطية الشعبية
وزارة التعليم العالي والبحث العلمي
جامعة قسنطينة 1 – الإخوة منتوري
كليـــــــــة العلوم الد قيـقة

PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH
Constantine 1 University – Frères Mentouri
FACULTY OF EXACT SCIENCES

ANNONCE DE SOUTENANCE



Conformément à la décision n° 121/ D3C/2026 du 09 Novembre 2026 autorisant la soutenance d'une thèse de doctorat, le Vice-doyennat chargé de la post-graduation, de la recherche scientifique et des relations extérieures, a n n o n c e la soutenance publique de :

THESE DE DOCTORAT DE

BELAKHDAR Sarra

EN Mathématiques, EN **Statistique appliquée**

Date : Mercredi 18 Novembre 2026 - Heure : 16h00

Lieu : Salle de conférences sise au C a m p u s Ahmed Hamani – Zerzara –
Département de Mathématiques

Sur le thème : « La prédiction dans les approches hybrides et complètes en Statistique B a y é s i e n n e ».

Devant le jury d'examen :

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Abstract

Bayesian statistics is a flexible and powerful approach to statistical inference. It relies on probability laws to explicitly model the uncertainty surrounding unknown parameters and to describe the relationship between these parameters and the observed data. Unlike classical approaches, it allows a priori information to be integrated and knowledge to be updated as data is accumulated.

This thesis proposes a Bayesian methodology dedicated to phase II clinical trials, aimed at ensuring dynamic monitoring and continuous evaluation of trial progress. The main objective is to estimate, at each stage, the probability of rejecting the null hypothesis using Bayesian prediction, while introducing a satisfaction index, denned as being decreasing function to the p-value. This measure quantile the degree of evidence in favor of the ecacy of the treatment under study.

We compare two methodological frameworks: a hybrid approach, combining frequentist and Bayesian elements, and a fully Bayesian approach. In addition, we develop and implement sequential analysis methods that enable intermediate decision-making, thereby contributing to the optimization and e_ciency of experimental designs.

The proposed methodology is based on a negative binomial model applied to binary trial data. This model is particularly relevant because it can account for strong heterogeneity and a high level of variability that more restrictive statistical models may fail to capture. It is therefore well suited to the analysis of rare events and overdispersed data. In this study, the negative binomial model is used as a probabilistic framework for formulating and testing a statistical hypothesis related to the success rate under investigation.

This framework is also positioned within a sequential analysis perspective
and contributes to experimental planning. The results highlight the value of the Bayesian approach, which provides a rigorous and _exible framework for hypothesis testing.

By combining prior information with observed data, this approach supports statistical decision-making in a structured manner. It therefore contributes to improving the planning and evaluation of clinical trials while enhancing the e_ciency of experimental designs.