ATENEO DE MANILA UNIVERSITY

SCHOOL OF SCIENCE AND ENGINEERING

RESEARCH COLLOQUIUM

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BOUND ON THE KOLMOGOROV DISTANCE FROM A GENERAL DISTRIBUTION IN WIENER SPACE

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ABSTRACT

The Central Limit Theorem, a classical result in Probability Theory, gives us a specific set of conditions for a sequence of random variables (r.v.) $\{X_n\}$ to converge to a Normal distribution. This convergence can be quantified by a distance function such as the Kolmogorov distance d_{Kol} since if $d_{\mathsf{Kol}}(X_n, Z) \to 0$ where $Z \sim \mathcal{N}(0,1)$, then $X_n \Rightarrow Z$. This distance is defined as $d_{\mathsf{Kol}}(X,Z) = \sup_{z\in\mathbb{R}} |\mathbb{P}(X \leq z) - \mathbb{P}(Z \leq z)|$. In our work, Z can have a more general distribution.

Our main result is the bound $d_{\mathsf{Kol}}(X,Z) \leq c\sqrt{\mathbb{E}\left[\left[\langle DX, -DL^{-1}X\rangle_{\mathfrak{H}} - g(X)\right]^2\right]}$, where c is some constant, D and L are Malliavin operators and g is a functional of Z. Thus for instance, if $\mathbb{E}\left[\left[\langle DX_n, -DL^{-1}X_n\rangle_{\mathfrak{H}} - g(X_n)\right]^2\right] \to 0$, then $X_n \Rightarrow Z$. Other research in this area have been done for r.v. X in Wiener space, but for comparisons to Normal distributions, or for general distributions as well but using other distance functions. Our work is our contribution to better understanding how sequences of r.v. can converge to non-Normal distributions.