CS 349F

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Final Report

This report summarizes and analyzes the topic covered in Prof. Kay Giesecke's lecture on "Machine Intelligence for Housing Finance." Across almost every industry, machine learning is disrupting conventional ways of doing business through its ability to leverage data and help optimize formerly time-consuming and/or subjective decisions; the financial realm is no different. Even today, housing applications are largely paper based and very manual. Even more so, decisions on underwriting the mortgage are primarily grid/rule-based, resulting in suboptimal approvals/denials being made. Thankfully, at all aspects of this process, there exist opportunities to collect data and leverage ML in order to intelligently automate aspects such as underwriting, pricing, insurance, and approvals. For example, in the underwriting phase, technologies such as KYC (Know Your Customer) detection and risk-scoring metrics can better inform decisions. On the securitization front, substantial funding has gone into ML for both trading these mortages and structuring into MBS. Not only is this crucial as more efficient and data-driven approach, but the societal impact could potentially result in an expanded access to credit for those in need while reducing systemic risk (ie avoiding another catastrophe like in 2008). This focus for data across these realms has yielded a plethora of different sources; for example, Zillow provides zip-code level economic and demographic data and CoreLogic has over 120 million data points on mortgages originated in the last ~25 years. Prof. Giesecke's analysis ingests this data and creates

a cloud-based deep learning model in which there are over 300 features. He finds that the predictive capability of 30 day delinquency and pre-paying (paidOff) are quite high. This model can then be plugged into a downstream portfolio that can comprise the objective of a trading strategy, for example. Ultimately, these algorithms and paradigms can also be applied across other lending areas, such as consumer, student, and auto (Forbes). As a student in his MS&E 246 course last quarter, I focused on the specific area of small business loans and was able to develop LGD (loss given default) models along with predicting distributions on early-payoffs vs default; a neural network based design proved to be quite effective in this case as well. This type of work is rapidly transforming the industry; for example, Kabbage, a unicorn startup out of Atlanta, approves small business loans in a matter of seconds. There should also be caution however. Algorithms may not necessarily lead to social equity and some decisions/predictions may not be easily explainable; this is something that regulators are looking at and do not have an easy answer to (Science Direct). As such, the rate of change in terms of some of the widespread adoption of "machine intelligence" is capped to some extent. Ultimately, while applications such as high frequency trading may only affect a certain subset of individuals (ie those active in the equity market), applications that Giesecke discussed have wide-ranging effects on millions of people

Sources Used:

http://web.stanford.edu/class/cs349f/slides/Giesecke%20Deck.pdf

https://www.forbes.com/sites/forbesfinancecouncil/2018/11/01/how-machine-learning-is-quietly-transforming-small-business-lending/#77bf55276acc

https://www.sciencedirect.com/science/article/pii/S2405918817300648