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DEGREE:	Philosophiae Doctor
FACULTY:	Mathematics and Natural Sciences
DEPARTMENT:	Informatics
AREA OF EXPERTISE:	Data Analytics – Machine Learning
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DISSERTATION TITLE:	<i>Big Data Analytics for the Future Energy System</i>

We are living in a world that is being shaped by algorithms, especially learning ones. Every one of us is experiencing the ever-increasing influence of learning algorithms on our daily behavior. For instance, 35% of Amazon product sales results from its recommender system, 75% of viewer activity in Netflix is driven by its recommendation engine, 70% of all trades in American markets is the result of algorithmic trading, and 40% of the prices of the 10,000 top products on Amazon is determined by a pricing engine that learns to set the product price based on customer demand, competitors prices, and other factors. The world will continue to be transformed by programs that are not written by us, but by learning machines that are trained on Big Data. With the appearance of these big data technologies, together with the recent development in networking infrastructure and sensor technologies, the human society is potentially witnessing the most significant change in the electricity value chain since its beginnings: the emergence of the future energy system, or better known as the smart grid.

This thesis provides a deeper understanding of the current power grid system, its transition to the smart grid, and the role of big data analytics in the process. By showing that the amount of data generated by a household in a smart grid is roughly equivalent to a Facebook user, or 0.3MB per day, the thesis emphasizes the big data challenge as well as how big data technology is needed to fuel the organic growth of a smart grid. This recognition leads to the proposal of Graph of Virtual Actors, a Big Data Analytics architecture for IoT (Internet of Thing) applications like smart grid. Furthermore, to demonstrate the potential of applying big data technologies in smart grid, the thesis proposes and experiments various novel and effective methods for automatic short-term load forecasting and automatic consumers segmentation.