Paris Session 2022

Learning hidden patterns in data to isolate scenarios

Power system development and economics

PS3 – Q3.1.1 Modelling for the stability analysis of networks is becoming probabilistic in nature. With the increasing penetration of renewable generation located in lower voltage networks, the complexity of power flow is magnified. It is not always practical to study each range of network and generation scenarios to search for each constraint. How can most onerous system conditions be isolated to study the network stability optimally?

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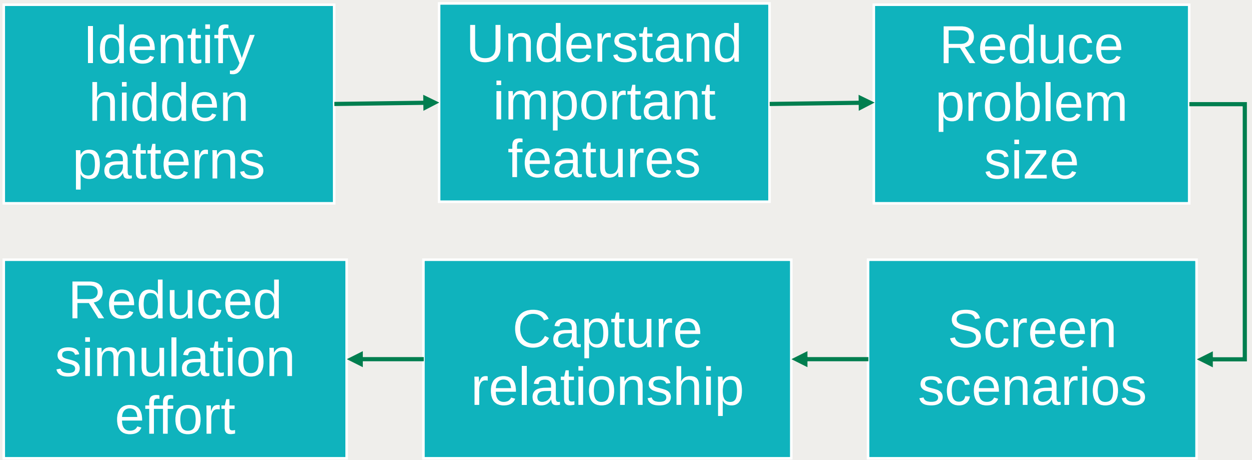
Isolating onerous system conditions

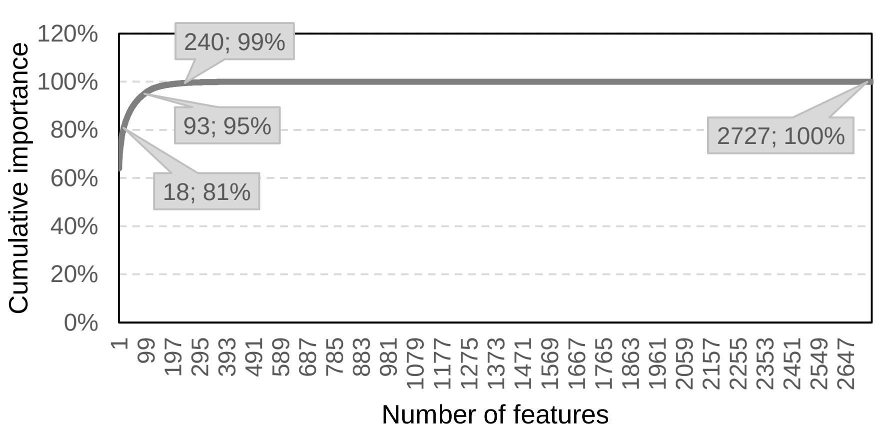
- Change in the generation mix and increasing uncertainty in certain system parameters – difficult to definitively identify most onerous scenarios
- Synchronous machine dynamics and interactions are well understood – engineering judgement played an important role in stability analysis of past networks
- In future networks, the dynamics of the system will be complex and not always defined by closed form equations – difficult to identify hidden threats

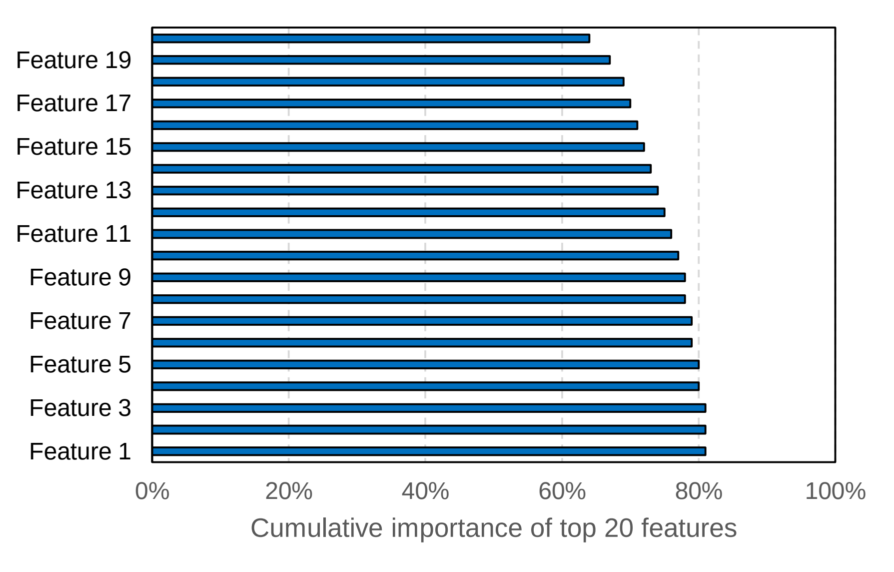
One way to approach this problem could be to borrow techniques from data science



Feature importance

- Feature importance indicates how valuable a feature is for learning the underlying pattern in the dataset
- In this example, around 2500 insignificant features can be ignored as features 240 to 2727 contribute to around 1% of the cumulative importance
- The insignificant features indicate that parts of the network can be replaced by equivalents – this reduces size of the problem
- The significant features give us an idea about the non-linear relationship of the system dynamics
- Screening of a few different scenarios will help us to identify the relevant engineering judgement required for this part of the network





Thank you for your attention !