AALBORG UNIVERSITY

Light-AI for Cognitive Power Electronics

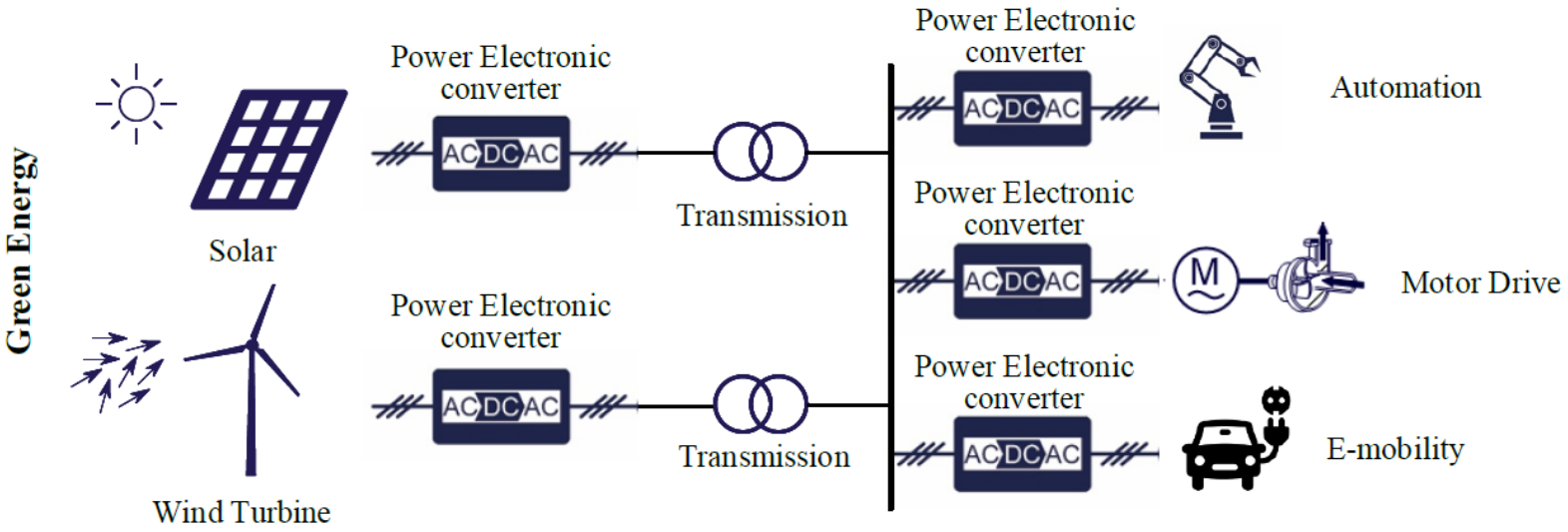
Bin Yang

Motivation

- State-of-the-art performance is often achieved by *complex* learning models.
  - Deep learning, such as CNNs and RNNs.
  - Ensemble learning, such as random forests.
- Limitations of the *complex* learning models.
  - ***Large space overhead*** to store the models and require ***long time to execute*** the models.
    - Neural networks with many layers and huge amount of weights.
    - An ensemble model consists of huge amount of base models.
- Prohibit their use in applications where storage space and computational power are limited, such as mobile devices and embedded devices.
  - Green energy: power electronics.
  - Industry 4.0: smart watches.

Power Electronics

- Solid-state electronics manage the control and conversion of electric power.



- Predictive maintenance (outlier detection)
  - Predict when power electronics device may break down.
  - Based on the operation (time series) data collected from various sensors deployed on power electronics.
- Limited storage and computational capability.
  - Unable to use deep learning and ensemble learning.

The Project

- Aim: develop **lightweight** AI *automatically*
  - Computational lightweight: compact learning models with competitive accuracy.
    - Model compression, less storage and computational power.
  - Data lightweight: effective learning models which do not rely on large amounts of human provided labels.
    - Unsupervised learning, self-supervised learning.
  - Automatically adapt to various power electronics with different hardware configurations.

- Collaborations
  - With energy department
  - With USC