Deep Neural Network (DNN) based soft sensor development for automotive fuel cell applications

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Objective

Monitoring fuel cell parameters under dynamic loading conditions to identify critical conditions.

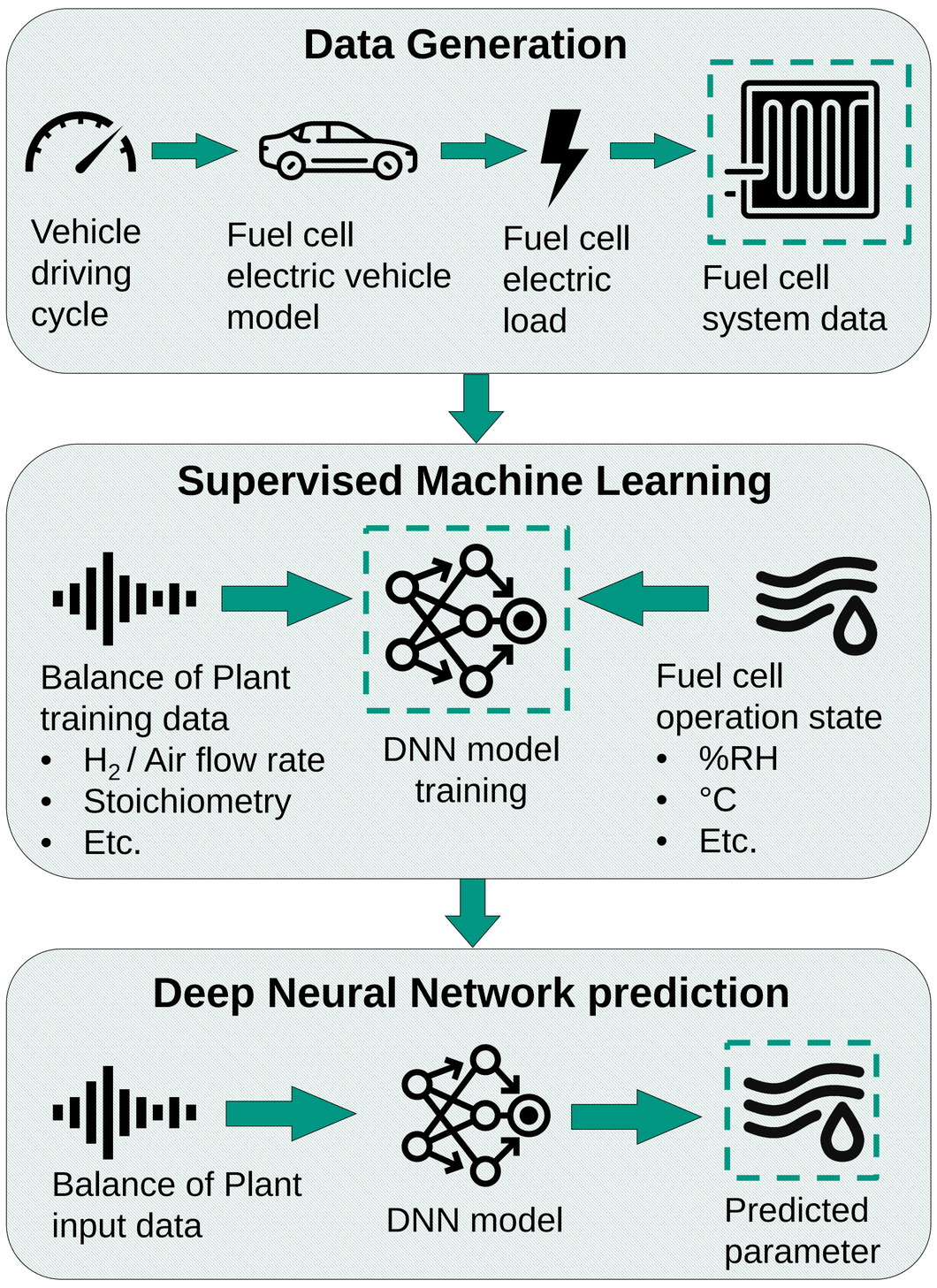
Motivation

Sensor integration can be technically and economically challenging in mass production of fuel cell stacks

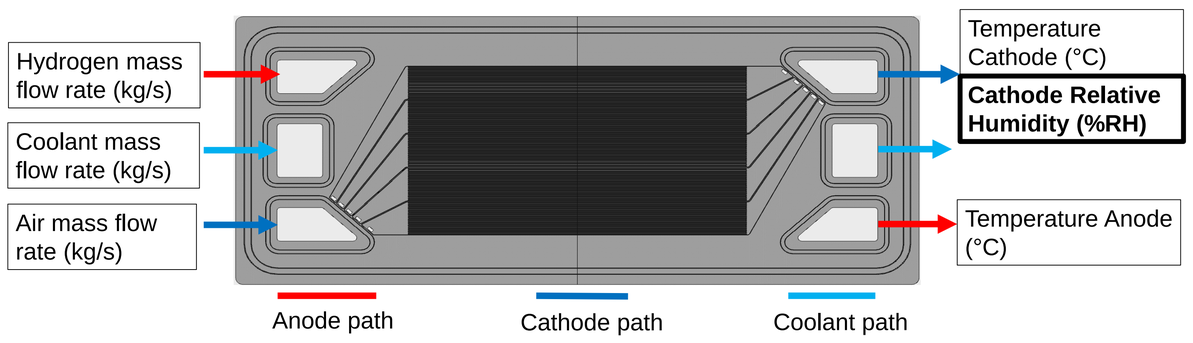
Fuel cell systems have complex interactions and are difficult to model.

Machine learning models can help in accurate diagnosis and prognosis of critical states in a fuel cell.

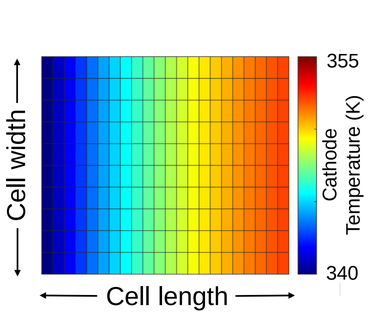
Methodology



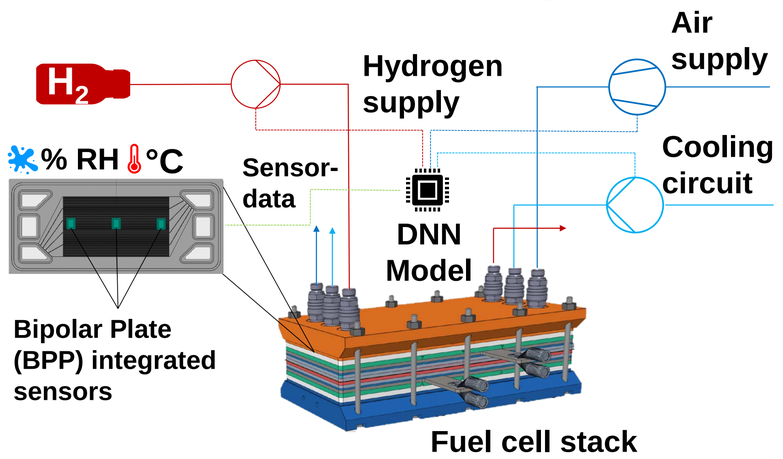
Setup



Simulation data for neural network modelling

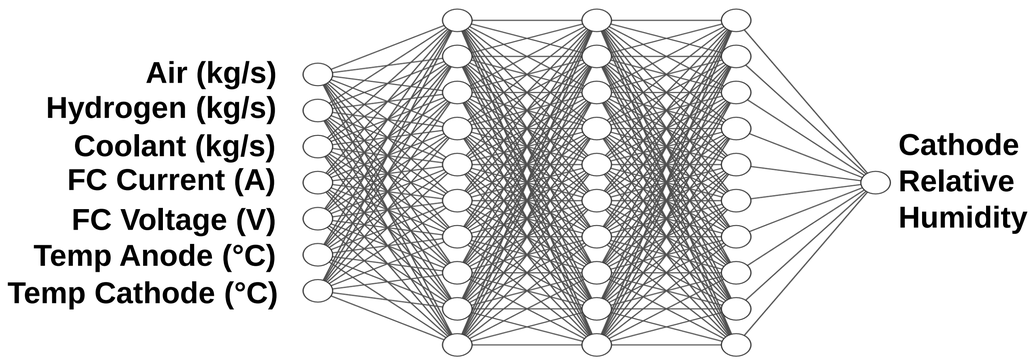


Temperature gradient across BPP active area



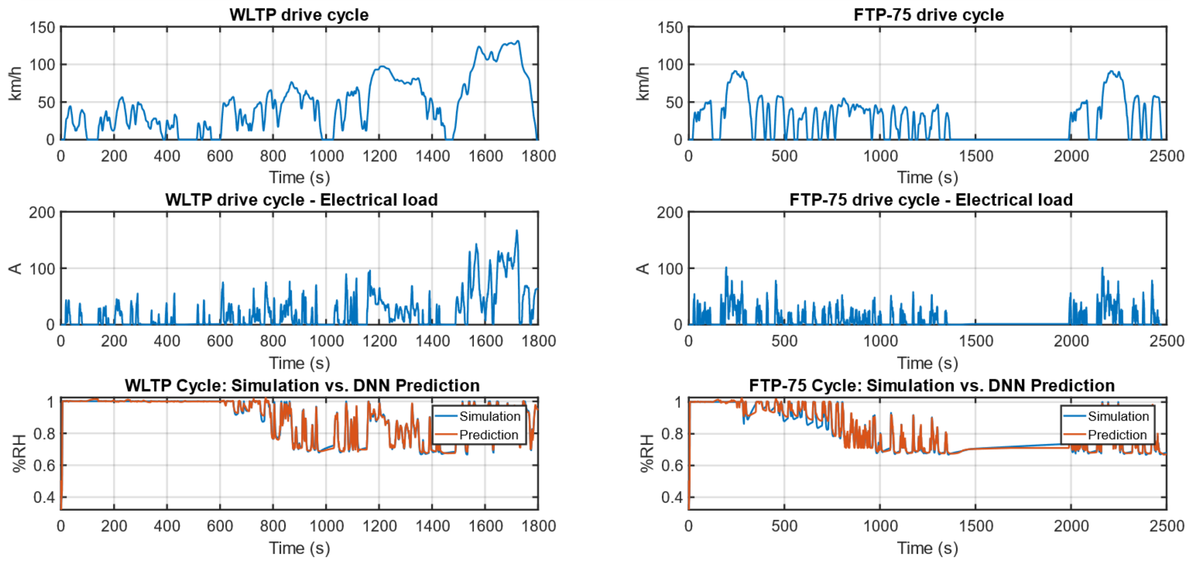
Planned experimental setup for ‚spatially resolved' measurements

Results & Conclusion



Fully connected 3 layered neural network. Layer size: 10, Activation: ReLU

DNN trained on WLTP driving cycle			
WLTP Test		FTP -75 Test	
RMSE	R Squared	RMSE	R Squared
0.0123	0.9887	0.0166	0.9817



DNN based ‚soft-sensor' accurately predicted relative humidity at cathode outlet with low RMSE and high R-Squared values for multiple automotive driving cycles, hence proving as a viable substitute for physical sensors in fuel cell systems.

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