Machine Learning Methods in Calculation of Old-Middle River Flow

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Old Middle River Flow

- Amount and direction of water flows in the South Delta between the lower San Joaquin River and CVP/SWP export facilities.
- Used in water management decisions to comply with court decisions and biological opinions under the Endangered Species Act.

Hutton 2008: Model Characteristics

- Empirical: Calibrated with data generated by DWR's Delta Simulation Model (DSM2) and validated with field observations
- Data Range: 1998 - 2006
- Higher accuracy in comparison to earlier models
- Model coefficients depend on HORB, GLC Barrier and Vernalis flow.

Table ES-3
MWD OMR Flow Model Coefficients

$$Q_{OMR}\ (cfs) = A * Q_{Vernalis} + B * Q_{South\ Delta\ Diversions} + C$$

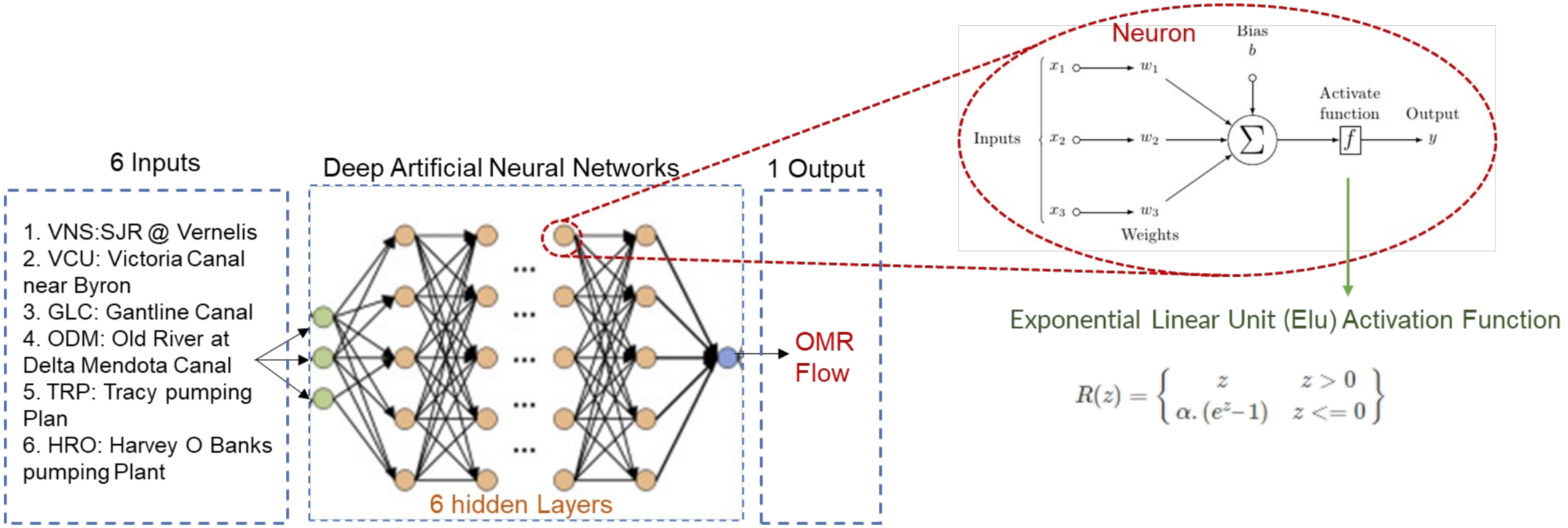
Where: $Q_{South\ Delta\ Diversions} = Q_{CCF} + Q_{Jones} + Q_{CCWD} + Q_{South\ Delta\ NCD}$

HORB	GLC Barrier	Vernalis (cfs)	A	B	C
Out	Out	< 16,000	0.471	-0.911	83
Out	Out	16,000-28,000	0.681	-0.940	-3008
Out	Out	> 28,000	0.633	-0.940	-1644
Out	In	All	0.419	-0.924	-26
In (Spring)	Out/In	All	0.079	-0.940	69
In (Fall)	Out/In	All	0.238	-0.930	-51

Question: Can we utilize machine learning models in the calculation of OMR flows.
Advantages: (1) longer time period covering wider range of climate and operational conditions. (2) no need to distinguish between different cases with different conditions.

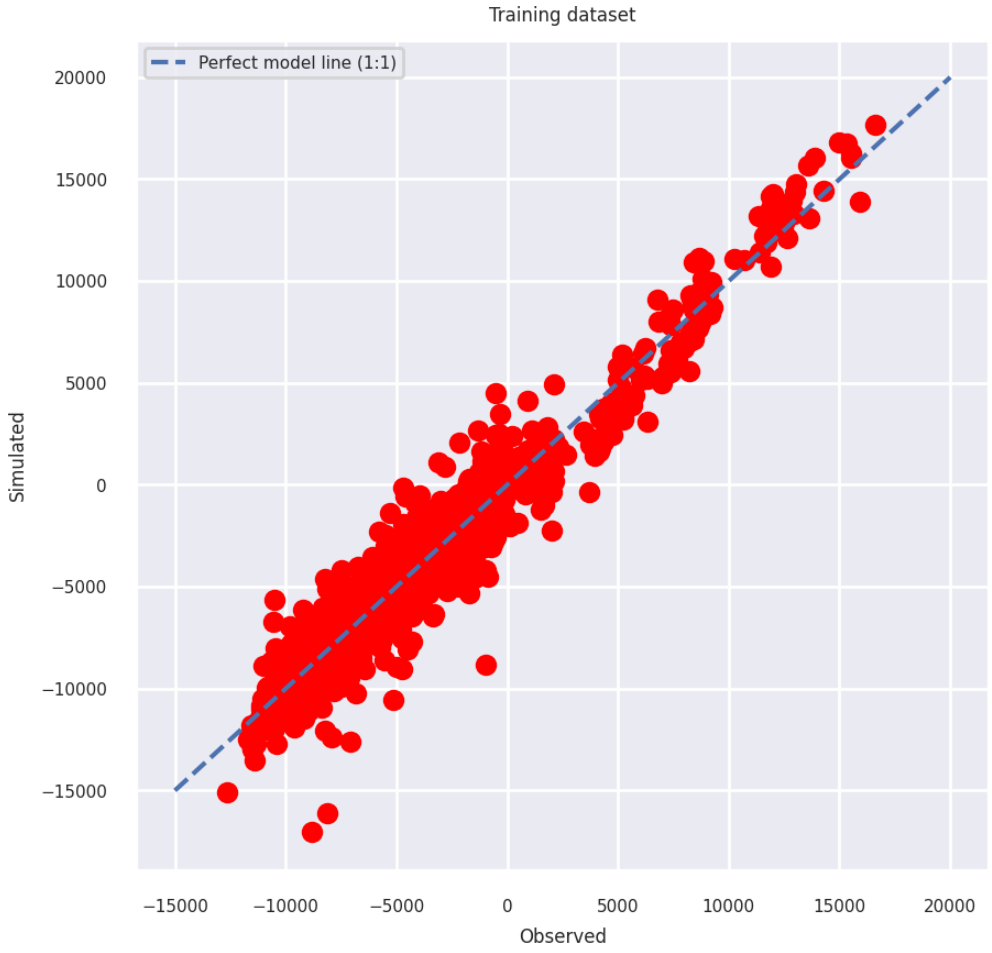
Deep Neural Networks (DNN) Approach for Predicting OMR Flow

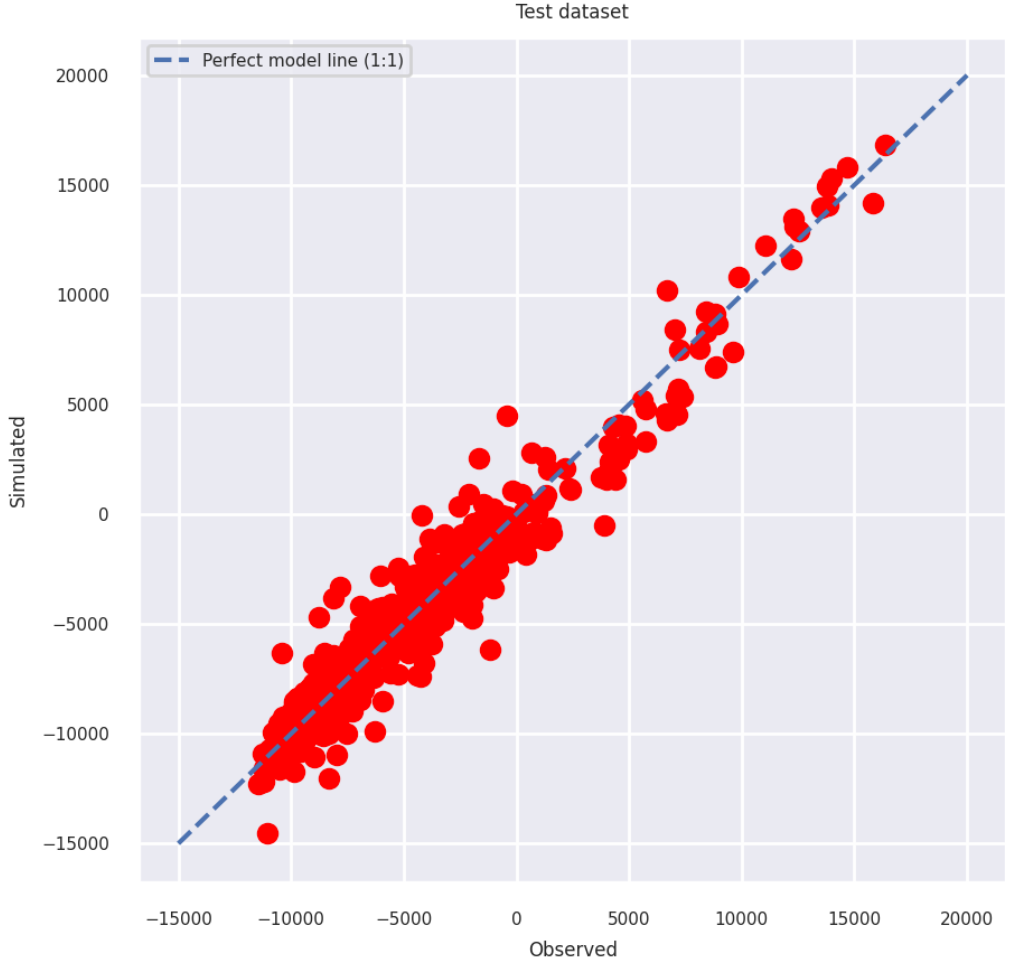
- DNN model with 6 inputs and 6 hidden layers was trained and tested.
- CDEC data from 2008 to 2015 - training (80%). Data from 2016 to 2017 - testing (20%).



DNN Model Performance Results

DNN Model Performance Metrics	R^2 (R-Squared)	MAE (Mean Absolute Error)
Training set	0.94	783
Test Set	0.93	843





Random Forests Approach for Predicting OMR Flow

- RF model with 100 trees was trained and tested.
- CDEC data from 2008 to 2015 - training (80%). Data from 2016 to 2017 - testing (20%).

DNN Model Performance Metrics	R^2 (R-Squared)	MAE (Mean Absolute Error)
Training set	0.99	253
Test Set	0.96	685