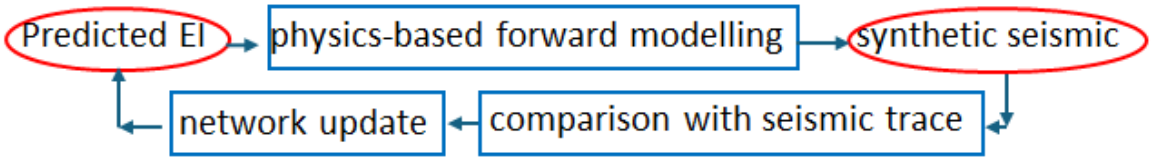
**Semi-supervised EI prediction**

A method was demonstrated to combine the information from, as usual, a limited number of wells and abundant seismic data to estimate the Elastic Impedance (EI) of a 2D/3D pre-stack data set. It used the seismic traces near the wells and the well logs as training data, but at the same time the neural net had to predict elastic parameters from the seismic, obviously updating the same network going through a loop of training using the wells and nearby seismic traces and fitting the seismic traces obtained by forward modelling based on the predicted elastic parameters. In this way the network was trained in a combination of supervised (wells & nearby seismic) and unsupervised (seismic only) learning.




As seismic samples are not independent the use of Gated Recurrent Units outperformed a network with only feed-forward Units like CCN.
The network had 4 modules: Sequence modelling (GRUs) → low-frequency trends, Local pattern analysis (CNNs) → high-frequency features, Upscaling (deconvolution) → match well-log resolution, Regression (GRU + FC layer) → output EI. This hybrid CNN-RNN architecture captured full-band information. Applied to a Marmousi inline, using ten traces ("wells") for supervised learning and 2720 traces for unsupervised learning resulted in a successful EI prediction & seismic recreation of the 2720 traces with a correlation of 98%. To obtain reservoir parameters a rock-physics model would still be needed. I wonder whether it has been applied on real 3D data since then?

Ref Alfarraj & AlRegib, Interpretation 2019, N8