PhD, Chemical Engineering

Effect of Pc and MW_{C6-} on the accuracy of Gas Condensate Dewpoint Pressure estimation using Neural network modelling

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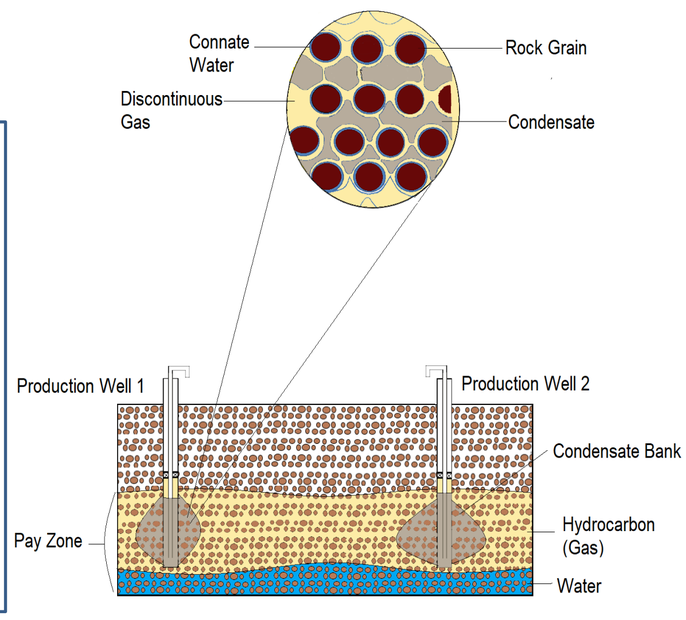
Introduction

Dewpoint pressure (DPP) is one of the most important factors to be evaluated by reservoir engineers while planning the development of a gas condensate reservoir. Below the dewpoint pressure, liquid condenses out of the gaseous phase. This liquid condensate forms a "ring" or "bank" around the producing well in the near-well region. Normally this liquid will not flow until its saturation exceeds the critical condensate saturation (S_{cc}) due to the capillary pressure and relative permeability of the porous medium. Hence it is very essential to accurately predict the dewpoint pressure of the reservoir fluid.

Numerous studies have been done on predicting dewpoint pressure using neural networks. All of these studies focus on four key input parameters: Reservoir Temperature, Specific gravity, Compressibility factor and Molecular weight of heavier components (C_{7+}). However, in this study, two multi-layer perception neural networks (MLPNN) were built. In developing the MLPNN models two new input parameters were introduced; Critical pressure and Molecular weight of lighter components (C_{6-}).

Objectives

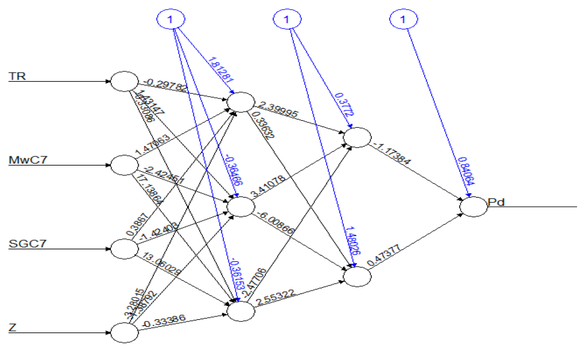
- To investigate the effect of critical pressure and molecular weight of lighter components on dew point predictive models
- To highlight the importance of neural architecture in the performance of the neural network model
- To compare results obtained with correlations and equations of state models

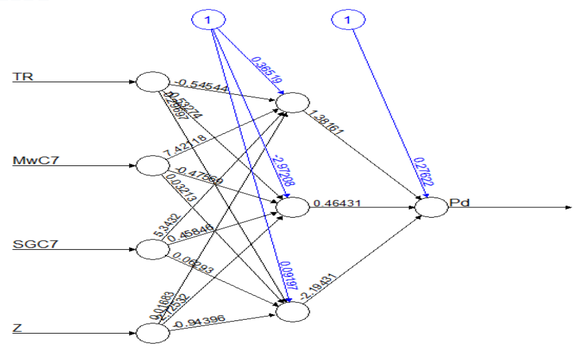


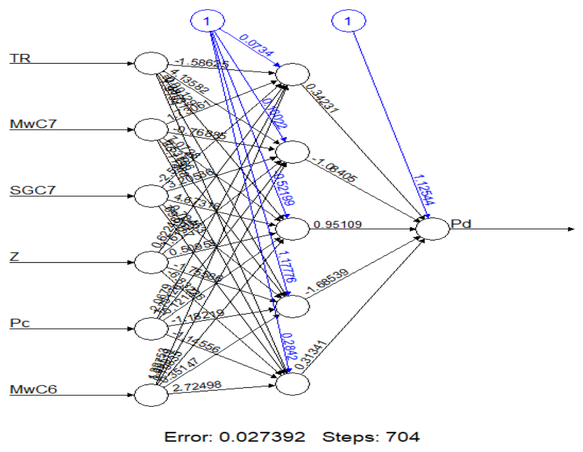
Input Data Set

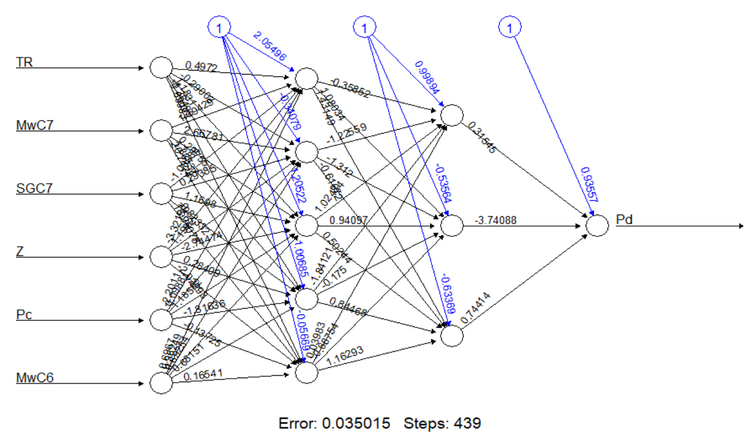
Parameter	Minimum	Maximum	Mean
DPP(psia)	1405	10,790	4747.2
TR(°F)	40	320	205.15
MWC7+	106	235	148.2
SGC7+	0.733	0.8681	0.788
N2	0	0.4322	0.01
CO2	0	0.9192	0.015
H2S	0	0.2986	0.006
C1 (mole fraction)	0.0349	0.9668	0.802
C2 (mole fraction)	0.0037	0.1513	0.057
C3 (mole fraction)	0.0011	0.109	0.03
C4 (mole fraction)	0.0017	0.203	0.02
C5 (mole fraction)	0.0006	0.0631	0.012
C6 (mole fraction)	0.0004	0.051	0.009
C7+ (mole fraction)	0.0019	0.1356	0.037

Neural Network Model Development

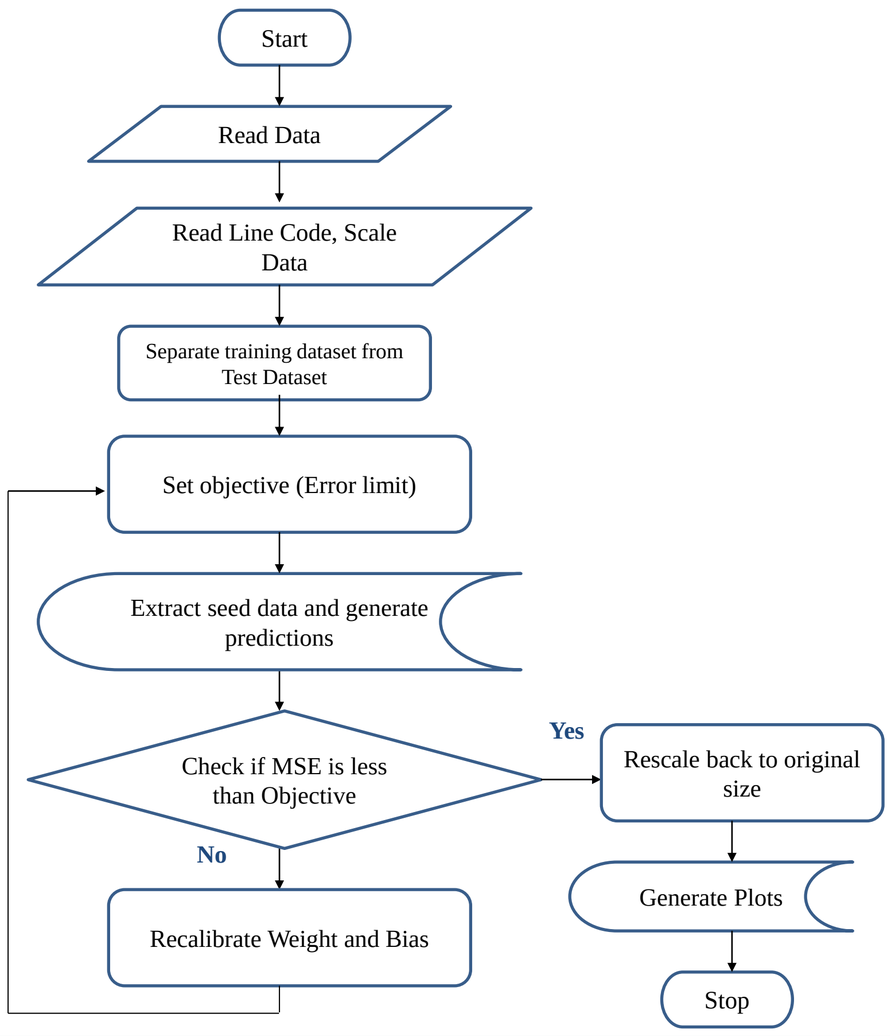




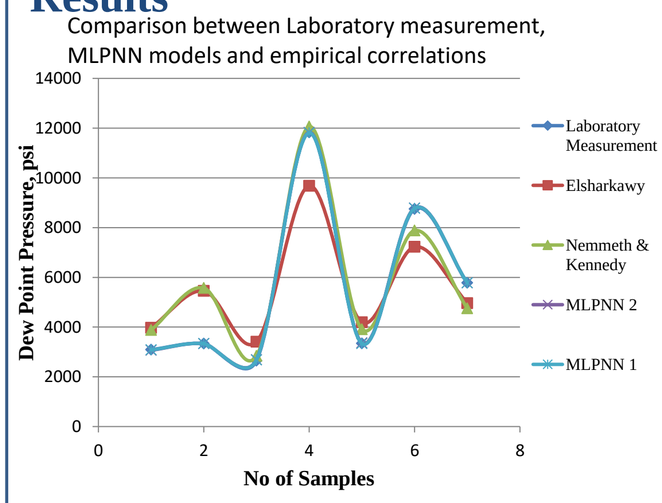


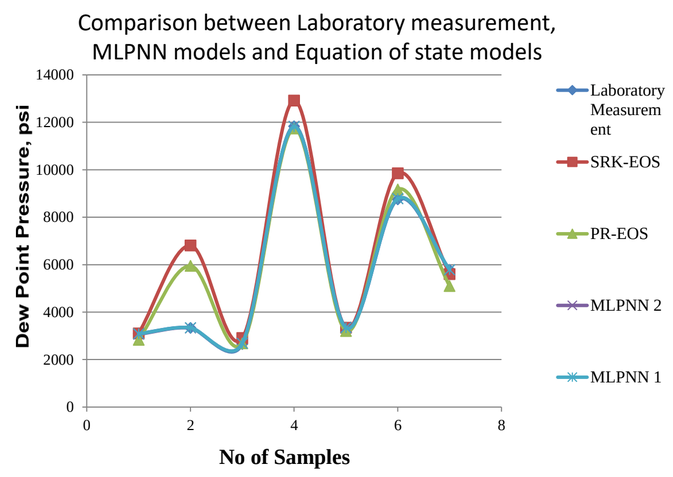


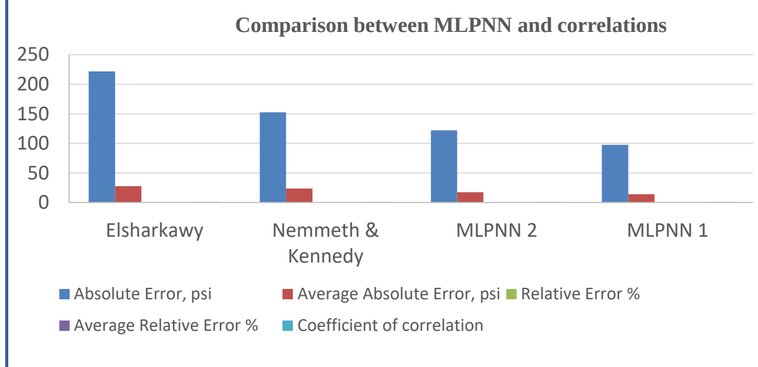
Methodology (Flow Chart)

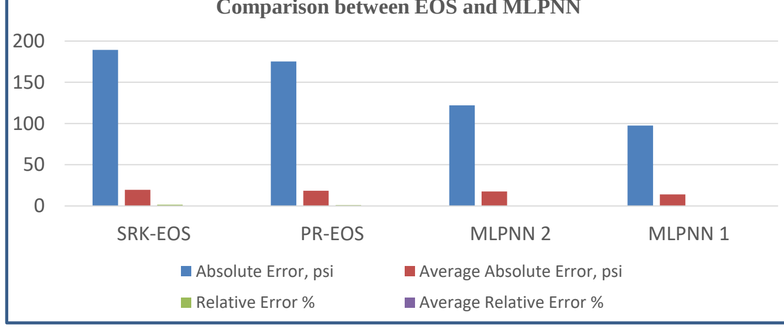


Results





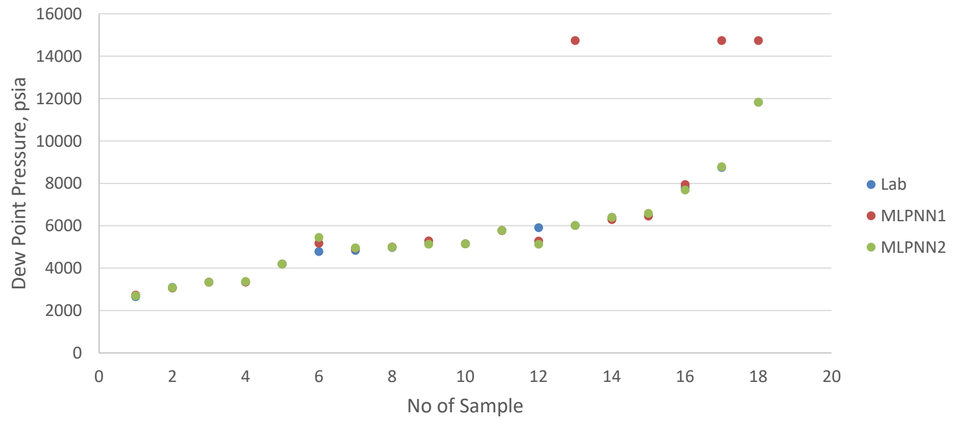




Discussion and Analysis

- EOS predictions are dependent on:
  - ✓ Binary Interaction Coefficient (BIC)
  - ✓ Volume shift parameter (S)
  - ✓ Critical pressure (P_c)
  - ✓ Critical temperature (T_c)
  - ✓ Acentric factor (ω) for the last carbon group
- Results from this study reveal superior accuracy from the MLPNN models (97.16%) compared to other empirical models (91.75%) and equations of state without tuning (90.6%).

Key Findings



Conclusion and future work

- Adding pseudo-critical pressure and molecular weight of lighter components of a gas sample **improves the accuracy** of its dew point Pressure predictions using neural network
- Altering the architecture of a neural network affects the accuracy of its prediction
- For future works, large data sets from various geographical regions should be used
- Also the use of different neural network type should be incorporated

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Key References

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