

Please fill in the name of the event you are preparing this manuscript for.	International Petroleum Technology Conference 2023 (15 th IPTC)
Please fill in your 5-digit IPTC manuscript number.	IPTC-23074-Abstract
Please fill in your manuscript title.	Multiscale Patchgan of a Single Pix2pix Network for Improved Simultaneous Prediction of Reservoir and Elastic Properties

Please fill in your author name(s) and company affiliation.

Given Name	Surname	Company
Muhammad Anwar	Ishak	PETRONAS Research Sdn Bhd/ Universiti Teknologi PETRONAS
A Halim	A Latiff	Universiti Teknologi PETRONAS
Eric Tatt Wei	Ho	Universiti Teknologi PETRONAS
Muhammad	Sajid	PETRONAS Research Sdn Bhd
Emad	Elsebakhi	PETRONAS Research Sdn Bhd
Nian Wei	Tan	PETRONAS Research Sdn Bhd

This template is provided to give authors a basic shell for preparing your manuscript for submittal to an IPTC meeting or event. Styles have been included (Head1, Head2, Para, FigCaption, etc) to give you an idea of how your finalized paper will look before it is published by IPTC. All manuscripts submitted to IPTC will be extracted from this template and tagged into an XML format; IPTC's standardized styles and fonts will be used when laying out the final manuscript. Links will be added to your manuscript for references, tables, and equations. Figures and tables should be placed directly after the first paragraph they are mentioned in. The technical content of your paper WILL NOT be changed. Please start your manuscript below.

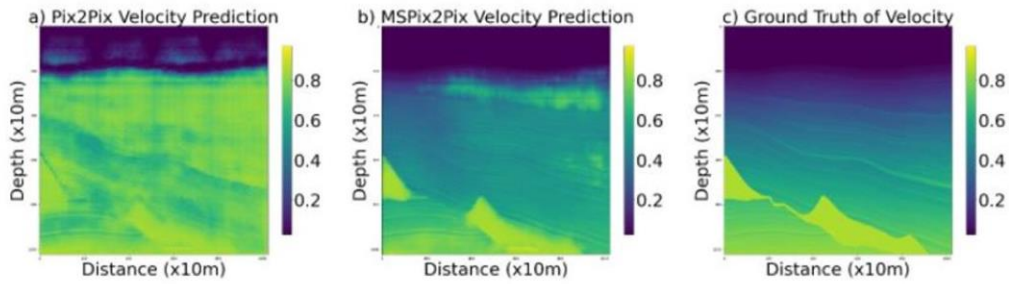
Abstract

Objectives/Scope: Accurate prediction of the elastic and reservoir properties has been the focus of petroleum geosciences. These properties are crucial in getting a more precise image of the subsurface thus increasing the chance of success in finding hydrocarbon. The objective of the paper is to propose multiscale Pix2Pix (MS-Pix2Pix) in predicting the subsurface properties simultaneously. MS-Pix2Pix is an enhanced version of Pix2Pix network which is a type of generative adversarial network or GAN.

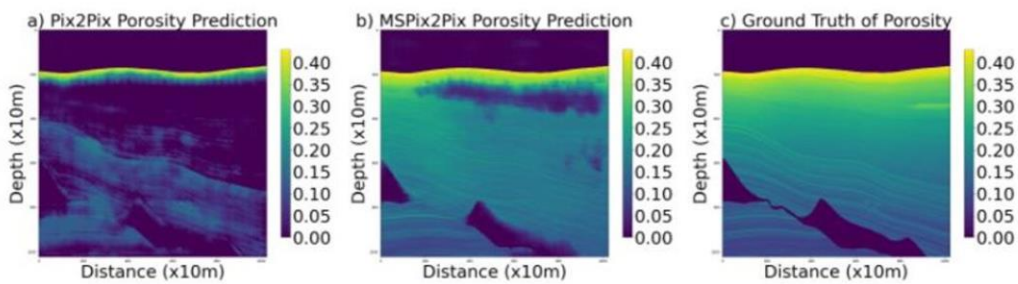
Methods, Procedures, Process: Data preparation. Each of the dataset is normalized to 0 and 1 range based on the property's fix values. **Model training.** Training is started with the default Pix2Pix setting for up to 2000 epochs. Quality control is done at every 50 checkpoints on the validation dataset. Model with the highest validation accuracy is selected as the base model. Next, the base model is re-trained using different discriminator's kernel size. The quality control process is repeated. Model with the highest accuracy is selected as final model. **Testing.** Both models are tested on 2 unseen datasets.

Results, Observations, Conclusions: In this paper, the multiscale Pix2Pix (MS-Pix2Pix) is proposed to transform the seismic post stack to several reservoir and elastic properties such as velocity, porosity, density and water saturation. The cross-correlation results for velocity prediction is 0.70 for Pix2Pix and 0.91 for MS-Pix2Pix, porosity prediction is 0.40 for Pix2Pix and 0.83 for MS-Pix2Pix, density prediction is 0.97 for Pix2Pix and 0.99 for MS-Pix2Pix and water saturation prediction is 0.43 for Pix2Pix and 0.84 for MS-Pix2Pix. As seen from the results, MS-Pix2Pix generates properties of higher accuracy as compared to the original Pix2Pix network. In addition, the use of the proposed method enables MS-Pix2Pix to predict several properties simultaneously with only one single network. With high accuracy of the results, the method is worth to be explored by the petroleum geoscience fraternity.

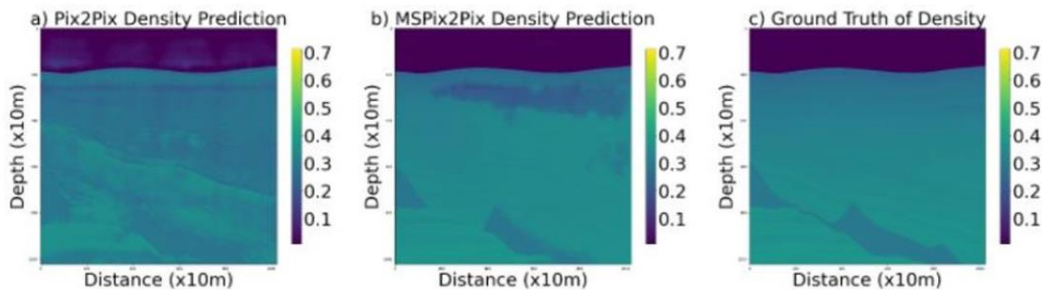
Novel/Additive Information: The main contributions are 1. The groundwork of a new method which is based on a generative adversarial network or GAN for properties prediction. Current existing methods are velocity model building and seismic inversion and rock physics. The new method is also entirely data driven. 2. The multiscale patchGAN which extracts features at different scale thus improving the accuracy of final predictions.



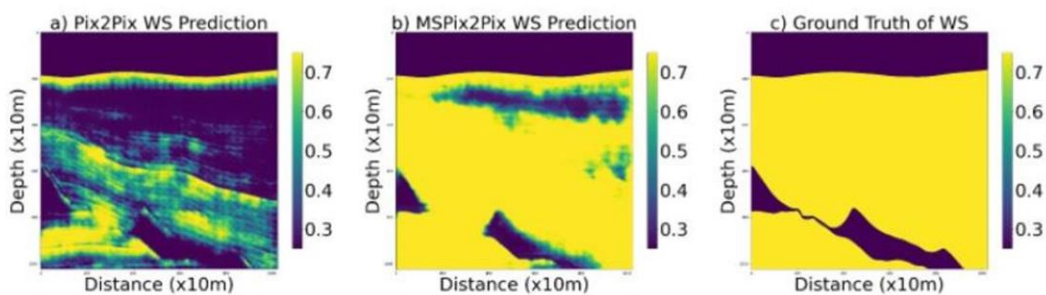
Velocity prediction results of Inline 1. Left: Prediction from pix2pix. Middle: Prediction from MS-pix2pix. Right: The ground truth. All displays are adjusted to the same scale



Porosity prediction results of Inline 1. Left: Prediction from pix2pix. Middle: Prediction from MS-pix2pix. Right: The ground truth. All displays are adjusted to the same scale



Density prediction results of Inline 1. Left: Prediction from pix2pix. Middle: Prediction from MS-pix2pix. Right: The ground truth. All displays are adjusted to the same scale



Water saturation prediction results of Inline 1. Left: Prediction from pix2pix. Middle: Prediction from MS-pix2pix. Right: The ground truth. All displays are adjusted to the same scale