Novel Use of Machine Learning to Efficiently Simulate Fracture in Polymer Composites

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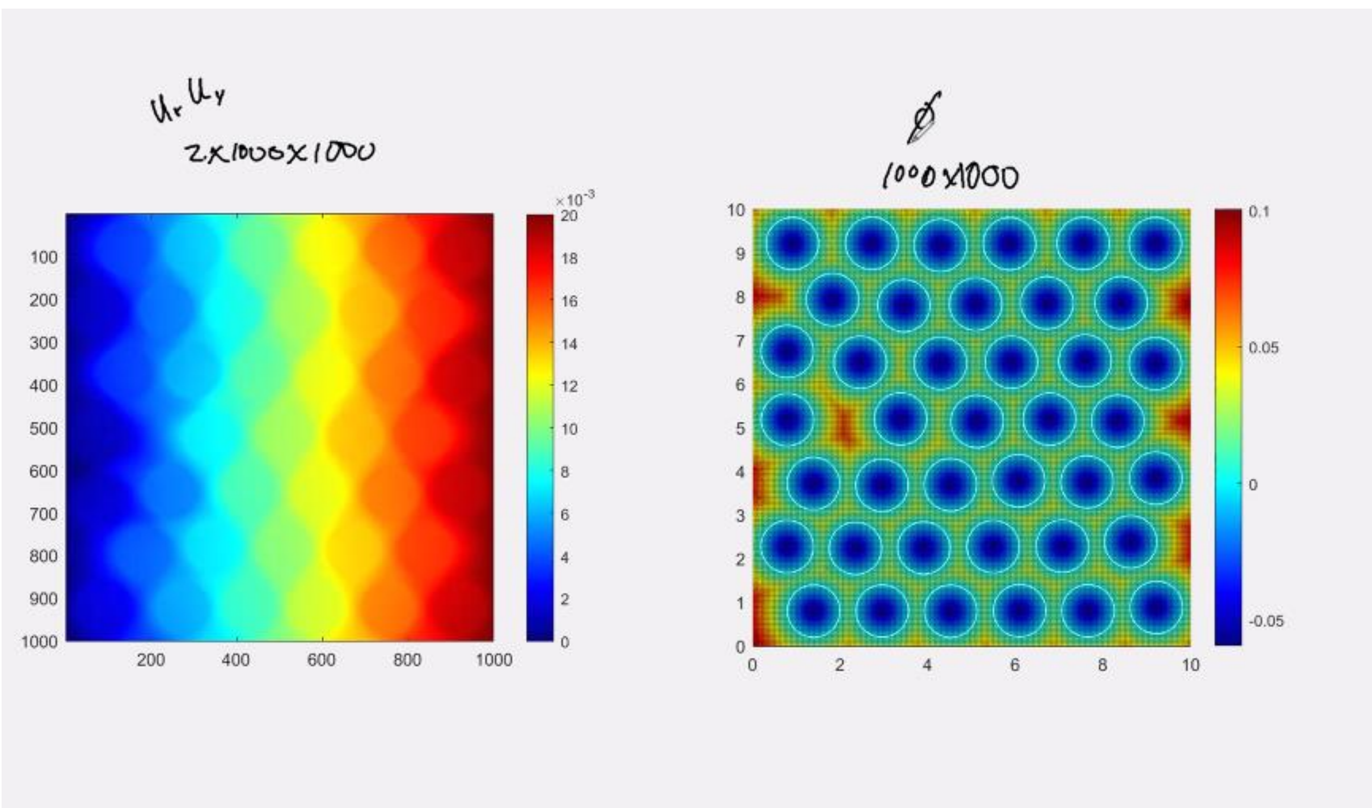
Can a neural network be used to speed up finite element analysis in certain material simulations?

Objective:

Find and train a machine learning architecture capable of quickly estimating the output of FEA



Application:

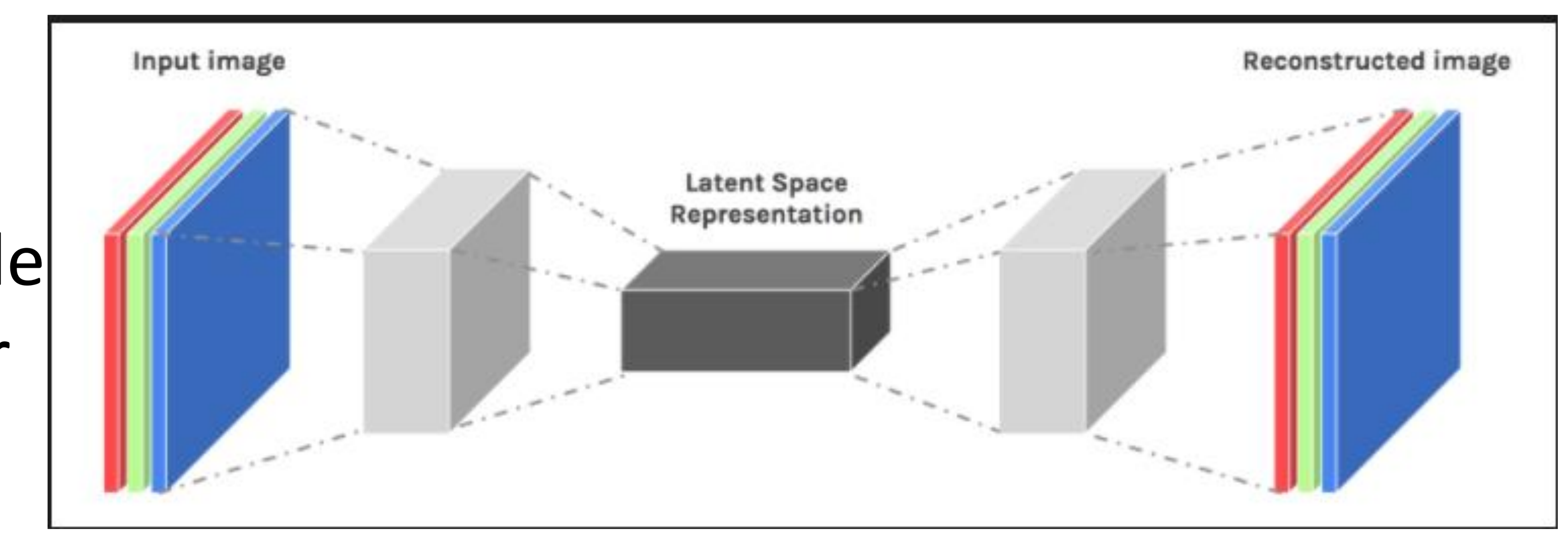
Fast finite element analysis will provide a tool for engineer's to develop better materials with a myriad of applications.

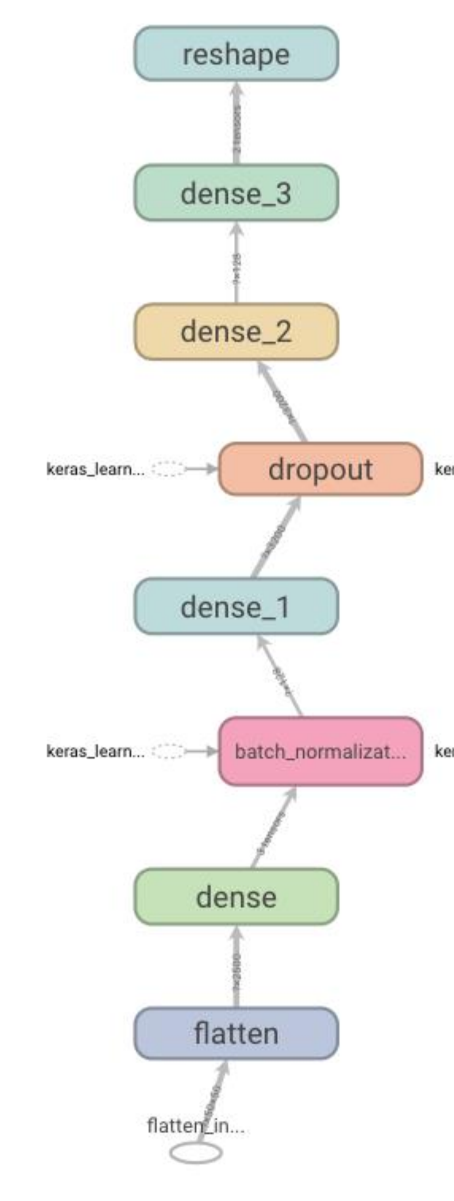
Method:

Build pipeline
Create architecture
Train architecture
Modify architecture
Retrain architecture

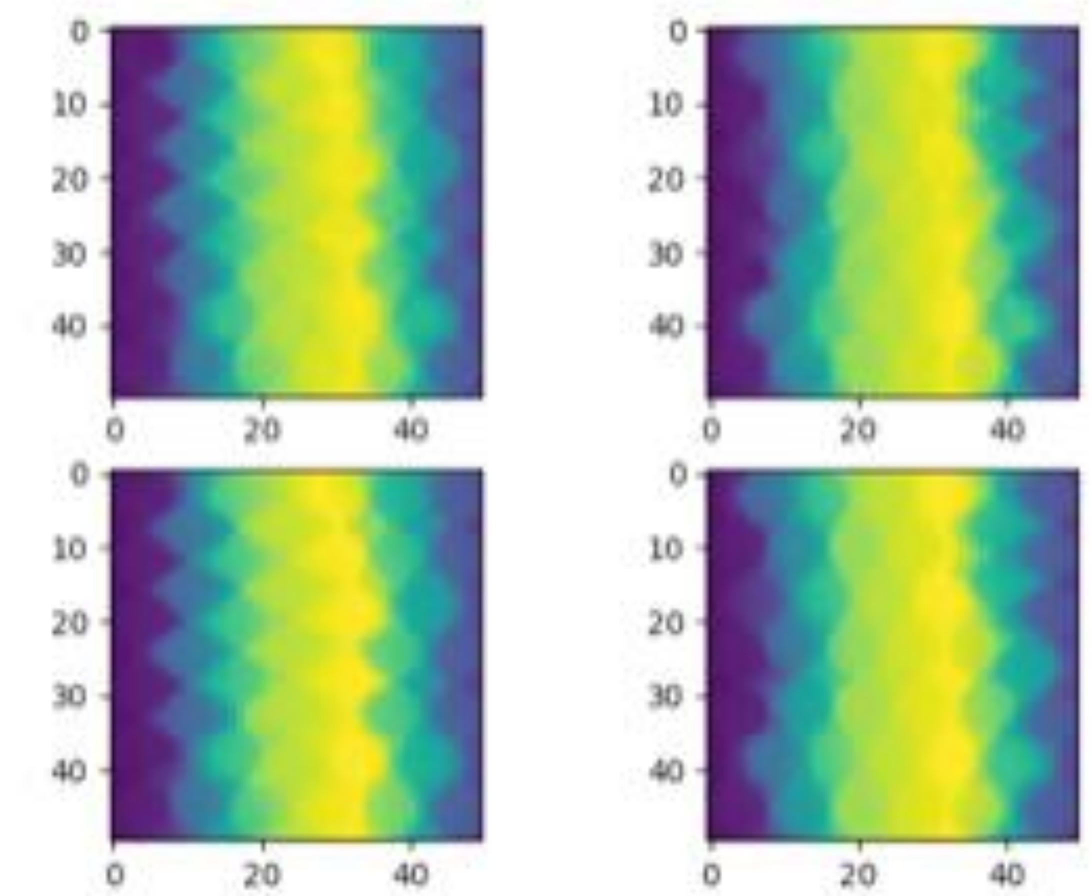
Architecture

In order to maximize speed, a reverse dense autoencoder was implemented with a single dropout layer and a single round of batch normalization





Results:



Validation loss (MSQ): 3.2E-4

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Epoch 400/400
16/16 [==============================] - 0s 18ms/step - loss: 1.3599e-04
- accuracy: 0.6447 - val_loss: 3.2087e-04 - val_accuracy: 0.5565
trained
```

FURI

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