



DHS SCIENCE AND TECHNOLOGY

Generative Adversarial Networks for Simulant Validation

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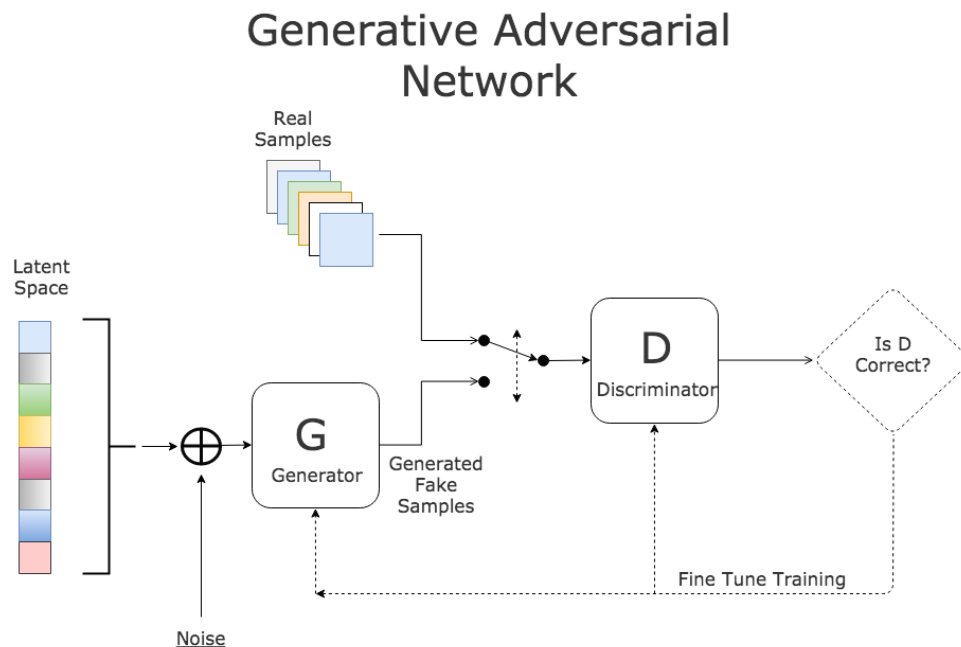
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TSLICC0xxxx

So What? Who Cares?

- A comprehensive method for simulant validation can help to standardize the measure of a simulant for a given threat material
- Texture is a complicated feature to characterize, what methods can we develop to quantify a material's texture and, ideally, its material properties simultaneously?
- We have leveraged a generative adversarial network trained on a single threat material, and then used the learned features in its discriminator to encode a simulant's feature set
- The simulant's features are compared to the target threat using similarity metrics such as L2 distance, frechet inception distance, etc in order to quantify the fidelity of the simulant
- TRL 5

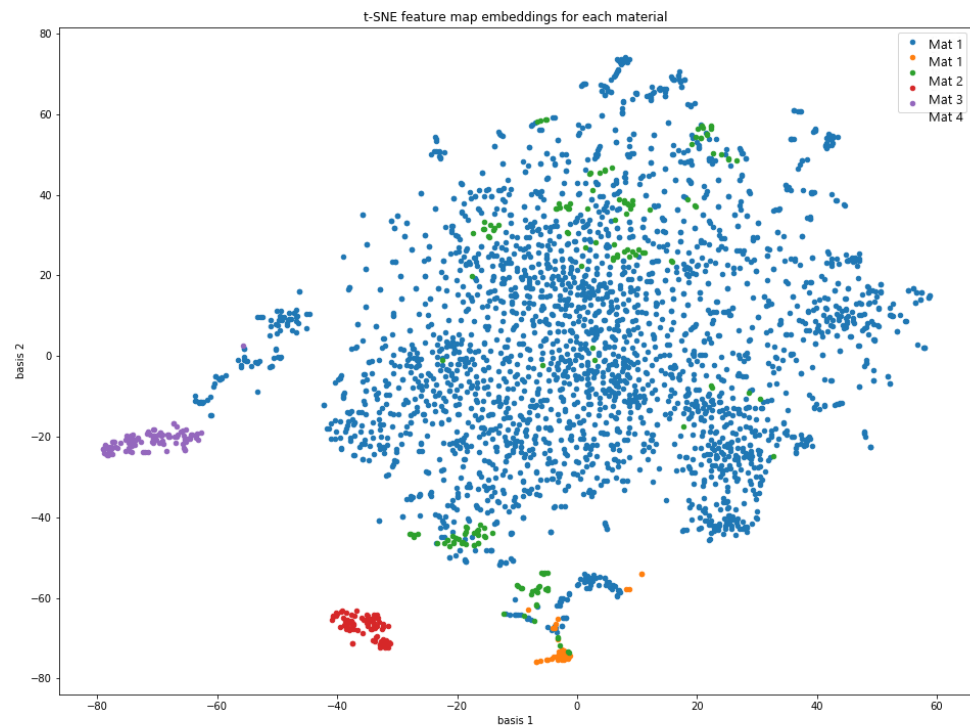
Generative Adversarial Network

- GANs consist of a discriminator (D) attempting to distinguish real and fake input data, and a generator (G) attempting to produce fake data that can fool the discriminator
- When trained on a single material, the discriminator becomes a good binary classifier for that material
- We can use it against simulants because it doesn't care if the "fake" data is from the generator or from real simulant scans



tSNE of Test Materials

- Blue and green points are the target material (train and validation sets, respectively)
- The rest of the datasets are separate materials for testing
- In viewing the image data along with the tSNE plot, it was able to cluster similar texture features from the encoded feature sets
- The separation of other materials (some that have similar texture) indicate it also learned some of the material properties





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DIVERSE PERSPECTIVES + SHARED GOALS = POWERFUL SOLUTIONS

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