Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

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# Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

John P. Stevens High School

August 2, 2020

Exploring Superconductors Using Generative Adversarial Networks

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- Superconductors have the potential to change the world
- Power transmission

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- Superconductors have the potential to change the world
- Power transmission
- Temperature

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- Superconductors have the potential to change the world
- Power transmission
- Temperature
- Investigation

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- Power transmission
- Temperature
- Investigation
  - Trial-and-error process

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- Power transmission
- Temperature
- Investigation
  - Trial-and-error process
  - Labor and resource-intensive

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- Power transmission
- Temperature
- Investigation
  - Trial-and-error process
  - Labor and resource-intensive
  - Every material's phase diagram must be completely mapped out

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# **Objectives**

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 Shorten the amount of time necessary to find a novel superconductor

# Objectives

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- Shorten the amount of time necessary to find a novel superconductor
- Allow researchers to inform their selection of a superconductor for experimental verification

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#### Data

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Taken from UCI (University of California, Irvine)
 Machine Learning Repository

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- Taken from UCI (University of California, Irvine)
   Machine Learning Repository
- 21,263 examples with 81 features

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- Taken from UCI (University of California, Irvine)
   Machine Learning Repository
- 21,263 examples with 81 features



Figure: UCI Machine Learning Repository

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Generative adversarial network (GAN)

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- Generative adversarial network (GAN)
- Generator uses the data given to it to create a model that can output data

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- Generative adversarial network (GAN)
- Generator uses the data given to it to create a model that can output data
- The discriminator "checks" this data

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- Generative adversarial network (GAN)
- Generator uses the data given to it to create a model that can output data
- The discriminator "checks" this data
- The two models train each other

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## Results

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Data was generated by the GAN

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- Data was generated by the GAN
- This data can now be tested to evaluate novel superconductors

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- Data was generated by the GAN
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 Usage of model can result in expedited time to find new superconductors

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- Usage of model can result in expedited time to find new superconductors
- Can be used in conjunction with regression model made on this data (Hamidieh 2018) to find high-temperature superconductors

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- Usage of model can result in expedited time to find new superconductors
- Can be used in conjunction with regression model made on this data (Hamidieh 2018) to find high-temperature superconductors
- Further studies can test the accuracy of this model by experimentally verifying superconductivity in the materials predicted

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# Acknowledgements

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 ${\sf Acknowledgements}$ 

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