Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction
Superconductivity
Objectives
Data
Methods
Results
Discussion
Conclusion
References
Acknowledgements

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

John P. Stevens High School

August 2, 2020

Outline

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Superconductors
Using Generative
Adversarial
Networks

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Introduction
Superconductivity

Objectives

Data

Methods

Results

Discussion

Conclusion

References

Acknowledgements

Introduction

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Using Generative
Adversarial
Networks

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Introduction

Exploring
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Using Generative
Adversarial
Networks

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- Superconductors have the potential to change the world

Introduction

Exploring
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Using Generative
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- Superconductors have the potential to change the world
- Power transmission

Introduction

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Using Generative
Adversarial
Networks

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

Introduction

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Superconductors
Using Generative
Adversarial
Networks

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- Superconductors have the potential to change the world
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- Investigation

Introduction

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Using Generative
Adversarial
Networks

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- Superconductors have the potential to change the world
- Power transmission
- Temperature
- Investigation
  - Trial-and-error process

Introduction

- Superconductors have the potential to change the world
- Power transmission
- Temperature
- Investigation
  - Trial-and-error process
  - Labor and resource-intensive

Introduction

- Superconductors have the potential to change the world
- Power transmission
- Temperature
- Investigation
    - Trial-and-error process
    - Labor and resource-intensive
    - Every material's phase diagram must be completely mapped out

Outline

Objectives

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- Shorten the amount of time necessary to find a novel superconductor

Objectives

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Superconductors
Using Generative
Adversarial
Networks

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Introduction

Superconductivity

Objectives

Data

Methods

Results

Discussion

Conclusion

References

Acknowledgements

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

Outline

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction
Superconductivity

Objectives

Data

Methods

Results

Discussion

Conclusion

References

Acknowledgements

Data

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Superconductors
Using Generative
Adversarial
Networks

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

Data

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

Data

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Figure: **UCI Machine Learning Repository**

Outline

Methods

Exploring
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Adversarial
Networks

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Methods

Exploring
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Using Generative
Adversarial
Networks

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- Generative adversarial network (GAN)

Methods

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

Methods

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Using Generative
Adversarial
Networks

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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

Methods

Exploring
Superconductors
Using Generative
Adversarial
Networks

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- The discriminator "checks" this data
- The two models train each other

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Superconductors
Using Generative
Adversarial
Networks

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Outline

Results

Exploring
Superconductors
Using Generative
Adversarial
Networks

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- TODO

Outline

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction
  Superconductivity

Objectives

Data

Methods

Results

Discussion

Conclusion

References

Acknowledgements

Discussion

Discussion

Exploring
Superconductors
Using Generative
Adversarial
Networks

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- Data was generated by the GAN

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

Discussion

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Superconductors
Using Generative
Adversarial
Networks

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Outline

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction
  Superconductivity

Objectives

Data

Methods

Results

Discussion

Conclusion

References

Acknowledgements

Conclusion

Exploring
Superconductors
Using Generative
Adversarial
Networks

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Conclusion

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Superconductors
Using Generative
Adversarial
Networks

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- Usage of model can result in expedited time to find new superconductors

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Superconductors
Using Generative
Adversarial
Networks

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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

Conclusion

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Superconductors
Using Generative
Adversarial
Networks

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Introduction
Superconductivity
Objectives
Data
Methods
Results
Discussion
Conclusion
References
Acknowledgements

- 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

Outline

References

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction
Superconductivity

Objectives

Data

Methods

Results

Discussion

Conclusion

References

Acknowledgements

Outline

Acknowledgements

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