Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

Introduction

Superconductivit

Objectiv

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.........

Results

Discussion

Acknowledgements

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John P. Stevens High School

August 8, 2020

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Superconductivity

Objectives

Б.

Method

Discussio

- -

- IntroductionSuperconductivity
- Objectives
- Data
- Methods
- Results
- Discussion
- Conclusion
- References
- Acknowledgements

Exploring Superconductors Using Generative Adversarial Networks

Raieev Atla

atroductio

Superconductivity

Objectives

S .

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Conclusion

References

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

ntroduction

Superconductivity

Data

Methods

Discussion

- -

Acknowledgements

Superconductors have the potential to change the world

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction

Superconductivity

Objective

Data

Method:

Discussio

- -

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

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction

Superconductivity

Objective

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Reference

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

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

Introduction

Superconductivity

Objectives

Data

....

Deference

- Superconductors have the potential to change the world
- Power transmission
- Temperature
- Investigation (Device Construction)

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction

Superconductivity

Objectives

Data

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Reference

- Superconductors have the potential to change the world
- Power transmission
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- Investigation (Device Construction)
 - Trial-and-error process

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction

Superconductivity

Objectives

Data

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Reference

- Superconductors have the potential to change the world
- Power transmission
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- Investigation (Device Construction)
 - Trial-and-error process
 - Labor and resource-intensive

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction

Superconductivity

Objectives

Data

Method

Discussion

Deference

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

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

ntroduction

Superconductivit

Objectives

Data

Methods

Results

Discussio

- -

- 1 Introduction
 - Superconductivity
- Objectives
- Oata
- Methods
- Results
- Discussion
- Conclusion
- References
- Acknowledgements

Objectives

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction

Superconductivit

Objectives

Mothod

Method

Discussio

- -

Acknowledgements

 Shorten the amount of time necessary to find a novel superconductor

Objectives

Exploring
Superconductors
Using Generative
Adversarial
Networks

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Superconductivity

Objectives

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Market

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Discussio

Reference

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

Exploring
Superconductors
Using Generative
Adversarial
Networks

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Introduction

Superconductivity

Data

Metho

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Discussio

- -

- IntroductionSuperconductivity
- Objectives
- Oata
- Methods
- Results
- Discussion
- Conclusion
- References
- 9 Acknowledgements

Data

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

Introduction

Superconductiv

Objective

Data

Method:

Discussion

Deference

Acknowledgements

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

Data

Exploring
Superconductors
Using Generative
Adversarial
Networks

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Objectives

Data

Method:

Discussio

Reference

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

Data

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21,263 examples with 81 features

Machine Learning Repository

Objectives

Data

Method:

.....

Discussio

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Acknowledgements



Taken from UCI (University of California, Irvine)

Figure: UCI Machine Learning Repository

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction

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Methods

Discussio

- -

- 1 Introduction
 - Superconductivity
- Objectives
- Data
- Methods
- Results
- O Discussion
- Conclusion
- References
- Acknowledgements

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

ntroduction

Superconductivity

Objective

Data

Methods

Results

Discussion

Conclusion

References

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

Introduction

Superconductivi

D. . .

Methods

Methods

a. .

Deference

Acknowledgements

Generative adversarial network (GAN)

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Superconductivit

Superconductiv

Objective

Data

Methods

Results

Discussio

Conclusio

Reference

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

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Communication

Objectives

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Methods

Results

Discussion

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

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introductio

Objective

Data

Methods

Discussio

Deference

- 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

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introductio

Objective

Data

Methods

Discussio

Deference

- Generative adversarial network (GAN)
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Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introductio

Superconductivity

Objective

Data

Method

Results

Discussio

- -

- IntroductionSuperconductivity
- Objectives
- Data
- Methods
- Results
- Discussion
- Conclusion
- References
- Acknowledgements

Results

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

troduction

Objective

Data

Metho

Results

Discussion

References

Acknowledgements

TODO

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction

Superconductivit

Objective

Data

Methods

.....

Discussion

D (

- Introduction
 - Superconductivity
- Objectives
- 3 Data
- Methods
- Results
- 6 Discussion
- Conclusion
- References
- 9 Acknowledgements

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

ntroduction

Superconductiv

Objective

Data

Methods

Results

Discussion

Conclusion

References

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

Introduction

Superconductivi

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Mathad

Discussion

Reference

Acknowledgements

Data was generated by the GAN

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

Introduction

Superconductivi

Objectiv

D. . . Ir.

Discussion

Reference

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

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

Introduction

Superconductivi

Objectiv

D. . . Ir.

Discussion

Reference

- Data was generated by the GAN
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Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introductio

Superconductivity

Objective

Data

Methods

Results

Discussion

Conclusion

- Introduction
 - Superconductivity
- Objectives
- 3 Data
- Methods
- Results
- 6 Discussion
- Conclusion
- References
- Acknowledgements

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

ntroduction

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Mothodo

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D'.....

Conclusion

References

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction

Superconductivi

Objectives

Data

Methods

......

Discussion

Conclusion

References

Acknowledgement

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

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

Introduction

Superconductivi

Data

Merno

Discussio

Conclusion

- 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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Superconductivi

Objective

Data

Method

Conclusion

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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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Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introductio

Superconductivity

Objectives

Data

Methods

Results

Discussio

References

Acknowledgement

Introduction

Superconductivity

Objectives

3 Data

Methods

Results

Discussion

Conclusion

References

References

Exploring Superconductors Using Generative Adversarial Networks

Rajeev Atla

ntroduction

Superconductivity

Objective

Methods

Discussion

References

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Introduction

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Discussio

Reference

- Introduction
 - Superconductivity
- Objectives
- Data
- Methods
- Results
- 6 Discussion
- Conclusion
 - References
- Acknowledgements

Acknowledgements

Exploring
Superconductors
Using Generative
Adversarial
Networks

Rajeev Atla

Superconductivi

Objectives

Date

Method

Results

Discussio

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