

The Models of London Bike Sharing Prediction

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Authors

- **Jingzi Chen**

 [86-13522264917](#) ·  [Jingzi2020](#)

Grainger College of Engineering, University of Illinois at Urbana-Champaign

- **Anye Wang**

 [15409980880](#) ·  [wanganye123](#)

Grainger College of Engineering, University of Illinois at Urbana-Champaign, Civil Engineering - Construction Management

- **Dana Monzer**

 [+1 2178191851](#) ·  [Dana2021](#)

Grainger College of Engineering, University of Illinois at Urbana-Champaign, Civil Engineering - Transportation Systems

Abstract

The aim of this study is to create a predictive model for bike-sharing counts in a n hour in the city of London in United Kingdom. The model makes use of regular neural network. And the main features affecting the bike counts include weather conditions and time. The model root mean square is 210, with a mean of 1124 counts in an hour compared to 1138 counts in an hour in the training data. The model provides enough accuracy for planning a new station and scheduling bike redistribution schedules.

Introduction

Bike-sharing system is an important mode in sustainable transportation modes. Great attention is put to improve such systems to increase their demand and maximize their environmental benefits along with other societal benefits. To study the demand of this system, London Bike-sharing system sis explored. The purpose of this study is to predict ranges of new bike counts each hour based on certain factors provided in the dataset. The aim of this report is to create a predictive model using machine learning to predict bike counts in a given hour in London city which is useful for planning and operation forecasting of bike-sharing system. The exploratory data analysis using graphical and statistical tools in Python were used to derive preliminary conclusions about the dataset by analyzing the results of the tools used. The dataset provided was acquired from three sources, to include the new bike counts in each hour, the weather conditions, and the holidays. The data from cycling dataset is grouped by “start time”, and it represents the count of new bike shares grouped by hour. The long duration shares are not taken in the count.” The data sample analyzed in this project is collected between January 1st, 2015 to January 1st, 2017 in London, UK and it includes the following parameters: - Timestamp (year, month, day, hour) - Cnt: the count of a new bike shares - T1: temperature measure taken in degree Celsius - T2: temperature feels - Hum: humidity percentage - Wind_speed: in Km/hr
- Weather_code: 1 = Clear ; mostly clear but have some values with haze/fog/patches of fog/ fog in vicinity 2 = scattered clouds / few clouds 3 = Broken clouds 4 = Cloudy 7 = Rain/ light Rain shower/ Light rain 10 = rain with thunderstorm 26 = snowfall 94 = Freezing Fog - Is_holiday: 1 if it is a holiday, 0 if it is not. - Is_weekend: 1 if it is a weekend, 0 if it is not.
- Season: 0: Spring, 1: Summer, 2: Fall, 3: Winter The sections below include literature review, description of methods, results, discussion and conclusion.

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Quotes and code

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        konstruktsiyah"
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Code block with no syntax highlighting:

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Figures



Figure 1: A square image at actual size and with a bottom caption. Loaded from the latest version of image on GitHub.



Figure 2: An image too wide to fit within page at full size. Loaded from a specific (hashed) version of the image on GitHub.



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Tables

Table 1: A table with a top caption and specified relative column widths.

<i>Bowling Scores</i>	Jane	John	Alice	Bob
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Table 3: A table with merged cells using the `attributes` plugin.

	Colors	
Size	Text Color	Background Color
big	blue	orange
small	black	white

Equations

A LaTeX equation:

$$\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2} \tag{1}$$

An equation too long to fit within page:

$$x = a + b + c + d + e + f + g + h + i + j + k + l + m + n + o + p + q + r + s + t + u + v + w + x + y + z + 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 \tag{2}$$

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The Models to Predict the Amount of Bike Sharing

Regular Neural Network

Based on the exploratory data analysis, regular neural network is used to figure out the project.

Neural network is a model that optimize the parameters through learning process to recognize hidden relationships between different data.

Because of the low correlation between given features, regular neural network probably is the most appropriate model to solve the project. The architecture of regular neural network is shown in Figure [9](#).

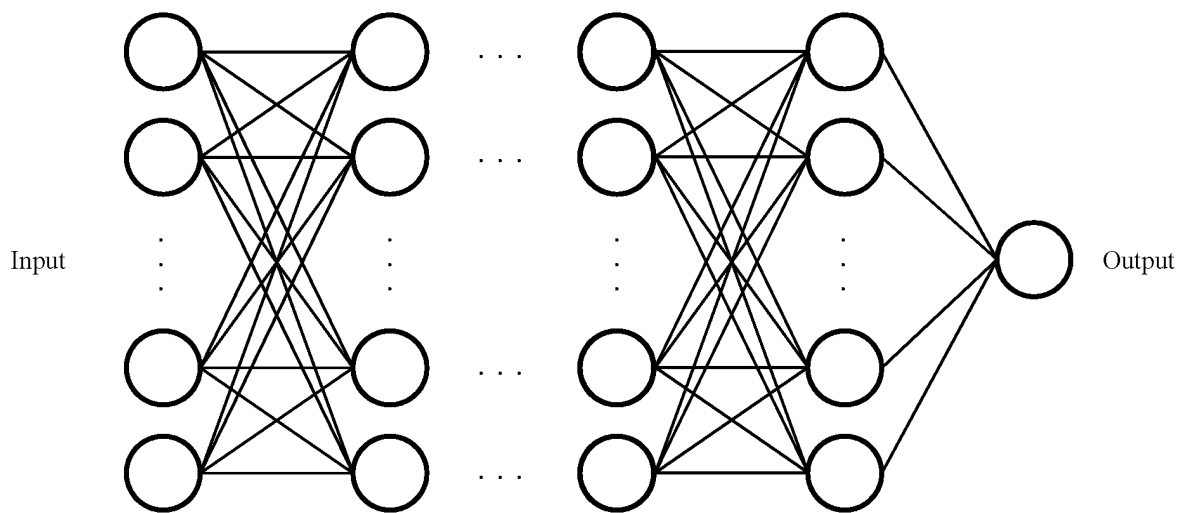


Figure 9: The Architecture of Regular Neural Network

There are 4 steps to build and train neural network, including:

- Selecting features;
- Data preprocessing;
- Designing layers and parameters;
- Determining training methods.

We used different features, epochs, hidden layers, units and learning rates in this project. The evaluation of the models' performances are based on the root mean squared error(RMSE) between the test data and predictions. The architectures of our models are shown in Figure [10](#), [11](#) and [12](#).

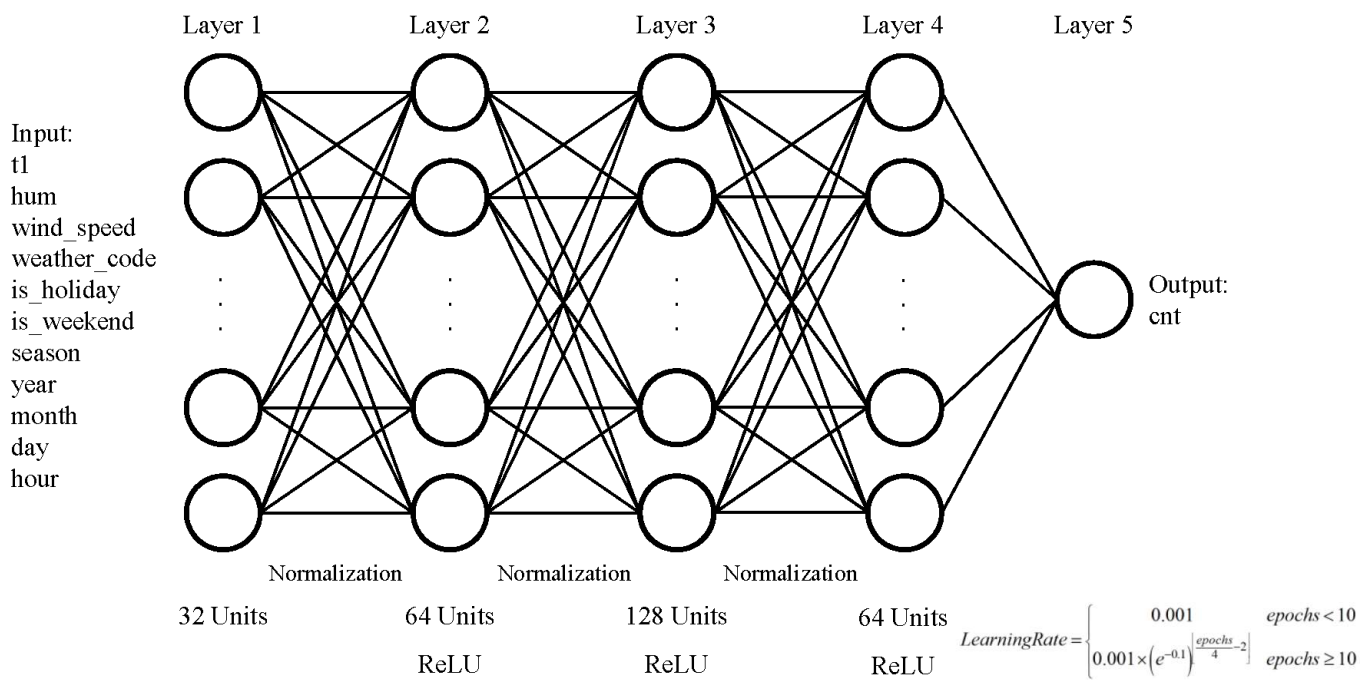


Figure 10: The Architecture of Jingzi's Model

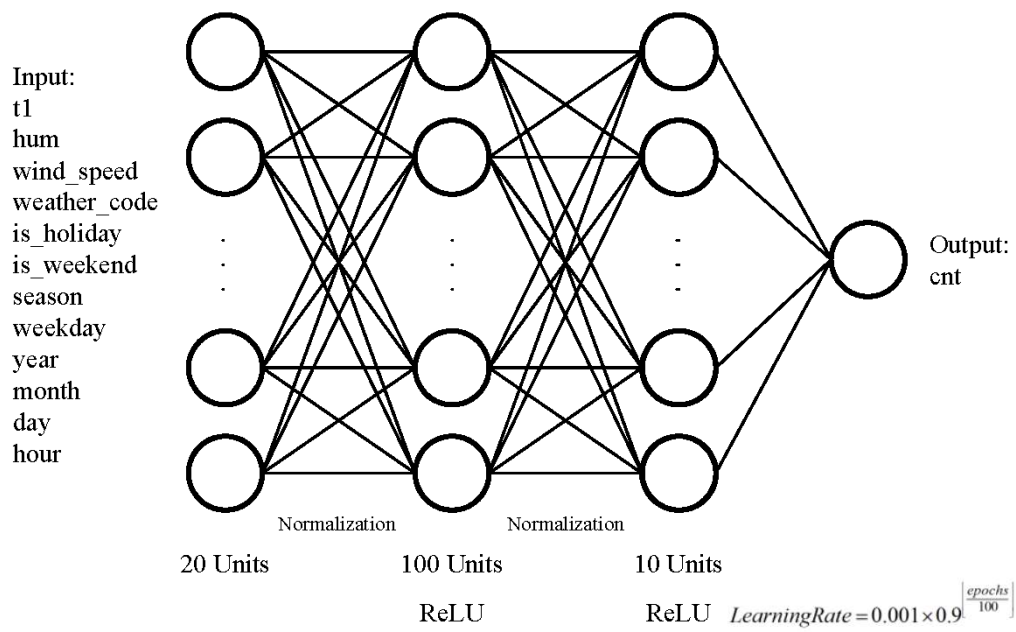


Figure 11: The Architecture of Anye's Model

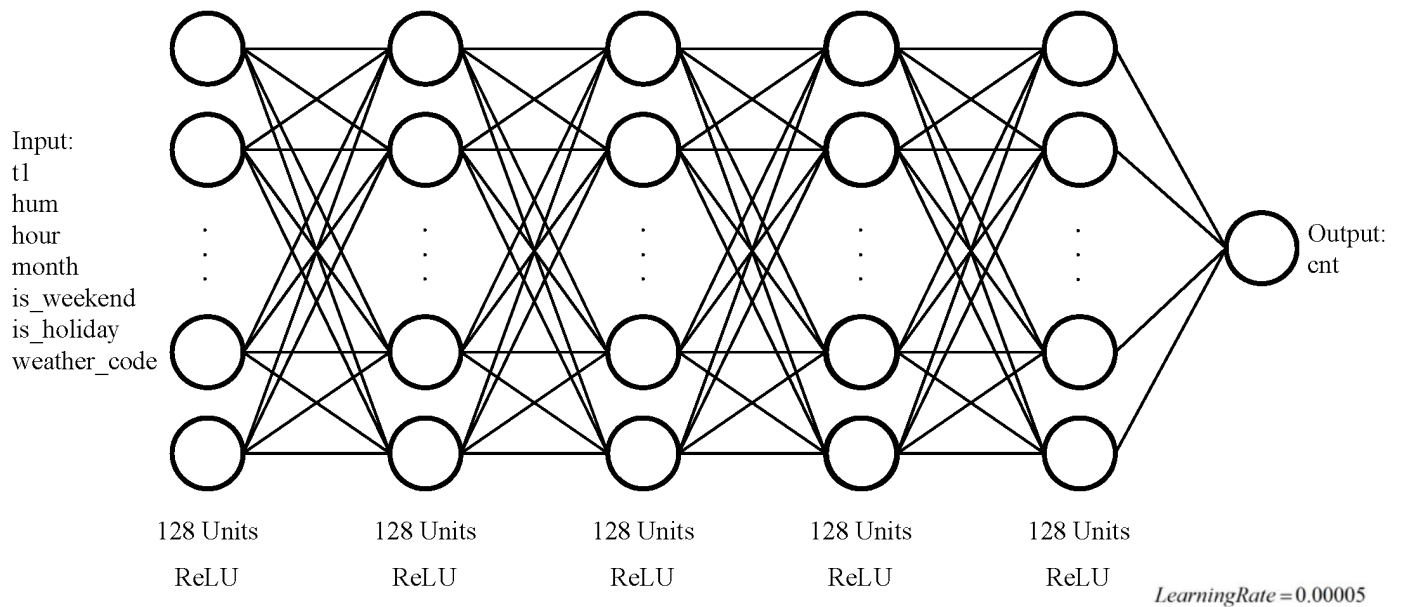


Figure 12: The Architecture of Dana's Model

Sensitivity Analysis

To evaluate and optimize our models, we analyzed the sensitivity of different parameters.

Units of Layers, Layers, Normalization and Learning Rates are analyzed. To avoid the influence of randomization, the evaluation of the performances is according to the average RMSE of 3 separate training with same initial parameters.

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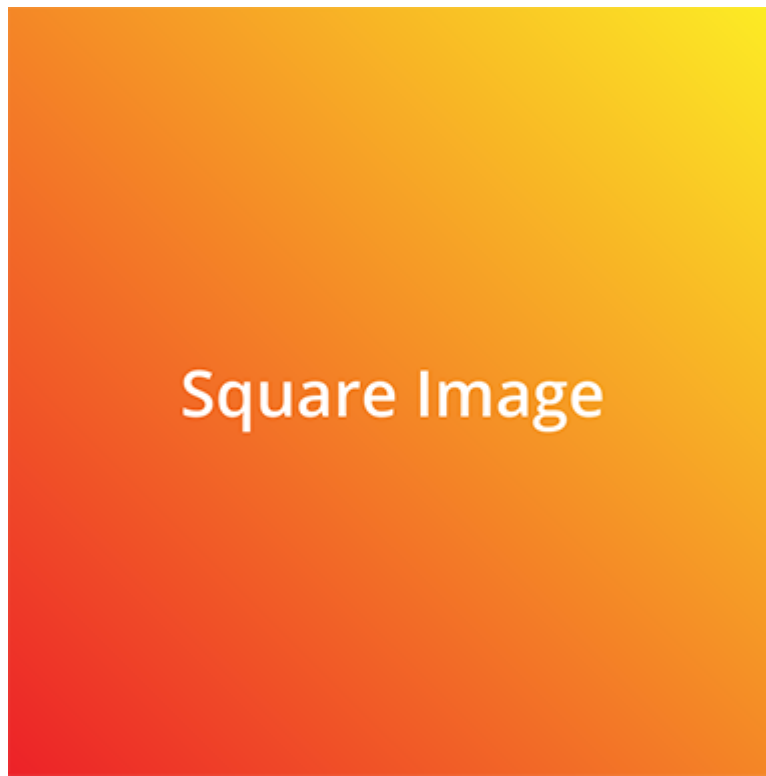


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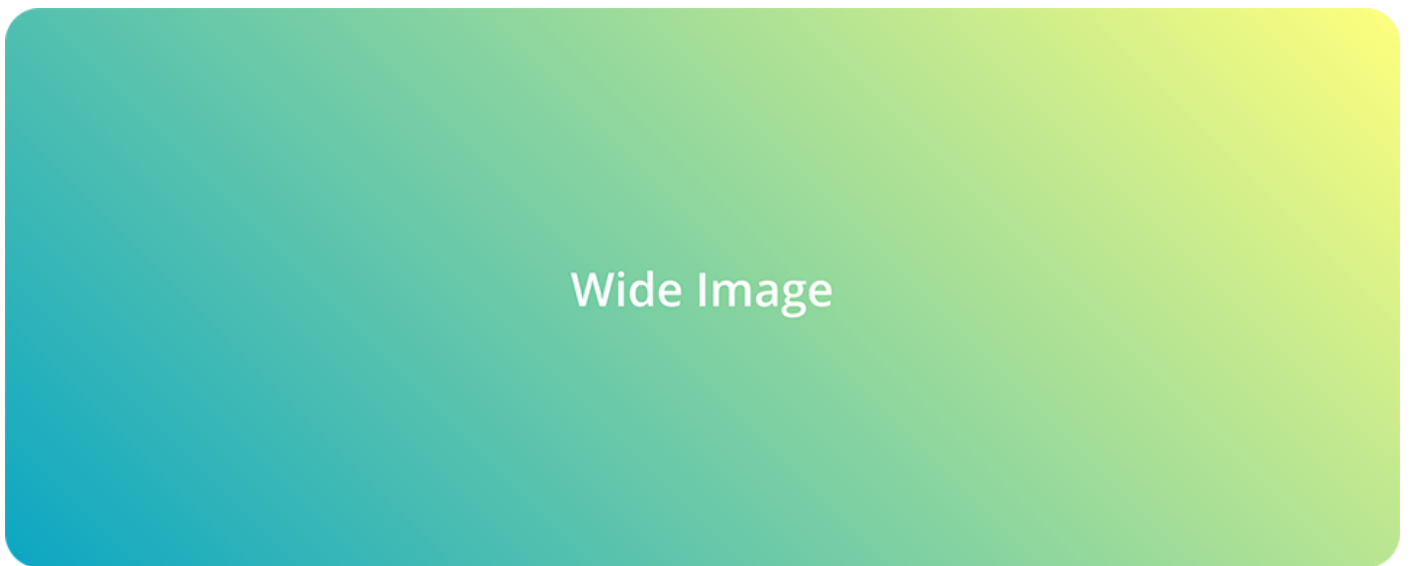


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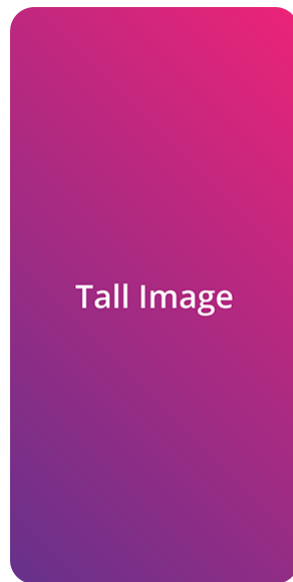


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Citation by PubMed ID [[3](#)].

Citation by Wikidata ID [[4](#)].

Citation by ISBN [[5](#)].

Citation by URL [[6](#)].

Citation by alias [[7](#)].

Multiple citations can be put inside the same set of brackets [[1](#),[5](#),[7](#)]. Manubot plugins provide easier, more convenient visualization of and navigation between citations [[2](#),[3](#),[7](#),[8](#)].

Citation tags (i.e. aliases) can be defined in their own paragraphs using Markdown's reference link syntax:

Referencing figures, tables, equations

Figure [21](#)

Figure [22](#)

Figure [23](#)

Figure [24](#)

Table [10](#)

Equation [9](#)

Equation [10](#)

Quotes and code

Quoted text

Quoted block of text

Two roads diverged in a wood, and I—
I took the one less traveled by,
And that has made all the difference.

Code `in the middle` of normal text, aka `inline code`.

Code block with Python syntax highlighting:

```
from manubot.cite.doi import expand_short_doi

def test_expand_short_doi():
    doi = expand_short_doi("10/c3bp")
    # a string too long to fit within page:
    assert doi == "10.25313/2524-2695-2018-3-vliyanie-enhansera-copia-i-
        insulyatora-gypsy-na-sintez-ernk-modifikatsii-hromatina-i-
        svyazyvanie-insulyatornyh-belkov-vtransfetsirovannyh-geneticheskikh-
        konstruktsiyah"
```

Code block with no syntax highlighting:

```
Exporting HTML manuscript
Exporting DOCX manuscript
Exporting PDF manuscript
```

Figures

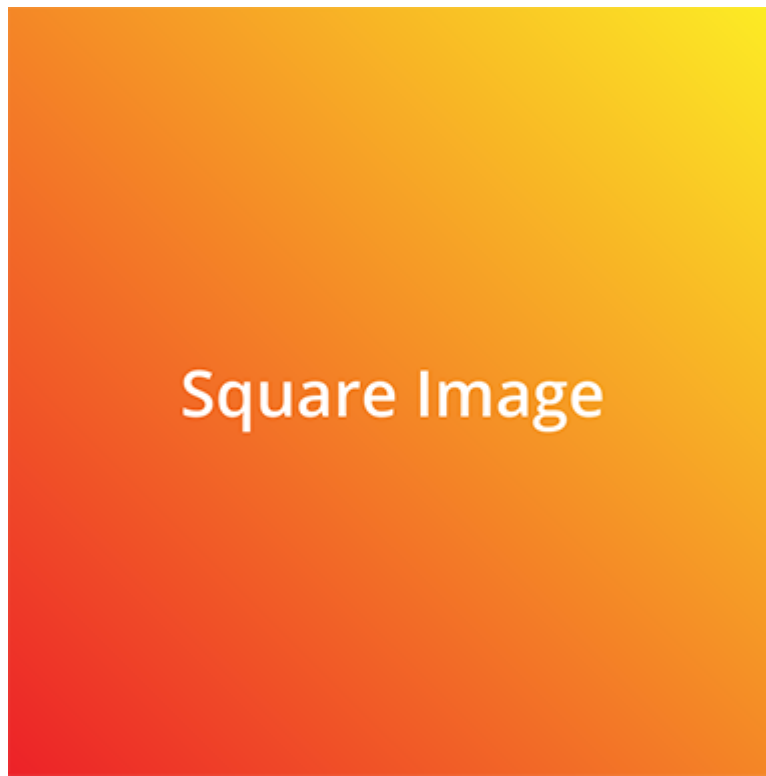


Figure 17: A square image at actual size and with a bottom caption. Loaded from the latest version of image on GitHub.

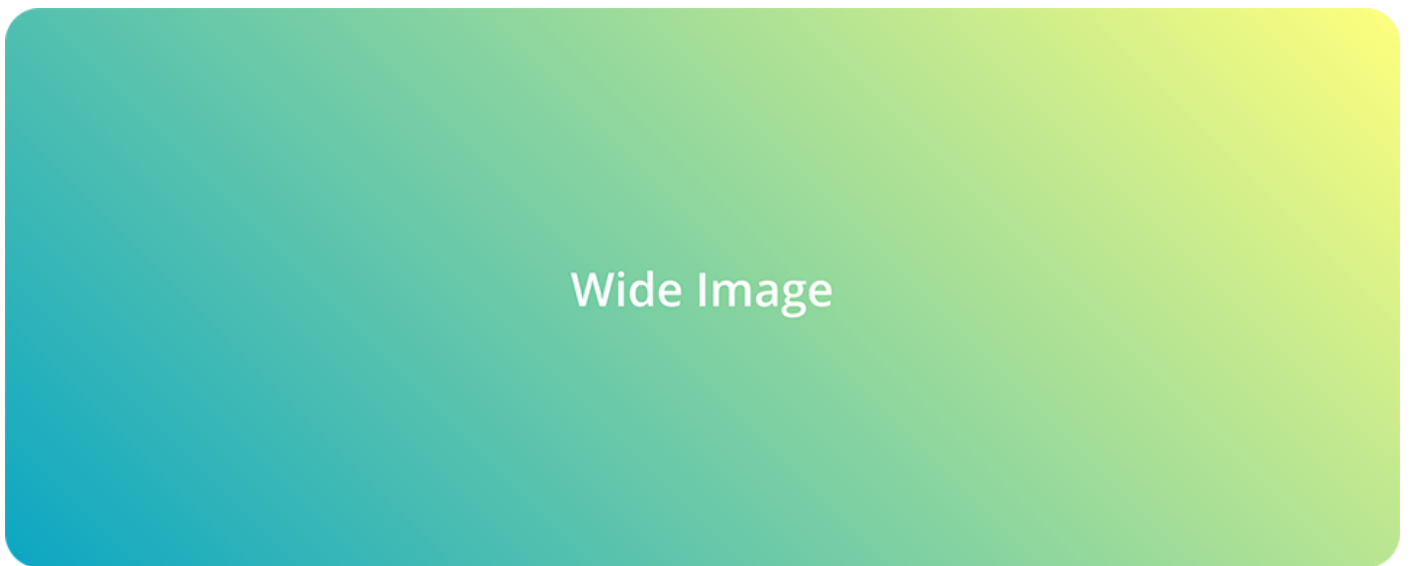


Figure 18: An image too wide to fit within page at full size. Loaded from a specific (hashed) version of the image on GitHub.

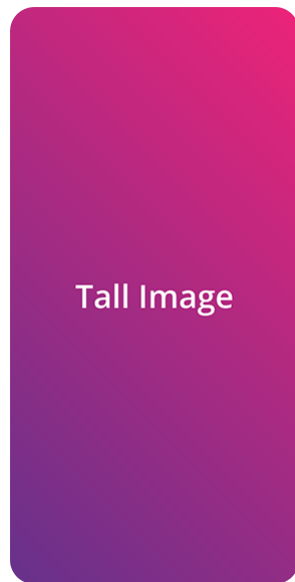


Figure 19: A tall image with a specified height. Loaded from a specific (hashed) version of the image on GitHub.



Figure 20: A vector `.svg` image loaded from GitHub. The parameter `sanitize=true` is necessary to properly load SVGs hosted via GitHub URLs. White background specified to serve as a backdrop for transparent sections of the image.

Tables

Table 10: A table with a top caption and specified relative column widths.

<i>Bowling Scores</i>	Jane	John	Alice	Bob
Game 1	150	187	210	105
Game 2	98	202	197	102
Game 3	123	180	238	134

Table 11: A table too wide to fit within page.

	Digits 1-33	Digits 34-66	Digits 67-99	Ref.
pi	3.14159265358979323846264338327950	288419716939937510582097494459230	781640628620899862803482534211706	piday.org
e	2.71828182845904523536028747135266	249775724709369995957496696762772	407663035354759457138217852516642	nasa.gov

Table 12: A table with merged cells using the `attributes` plugin.

	Colors	
Size	Text Color	Background Color
big	blue	orange
small	black	white

Equations

A LaTeX equation:

$$\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$$

(7)

An equation too long to fit within page:

$$x = a + b + c + d + e + f + g + h + i + j + k + l + m + n + o + p + q + r + s + t + u + v + w + x + y + z + 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9$$

(8)

Special

⚠ WARNING *The following features are only supported and intended for `.html` and `.pdf` exports. Journals are not likely to support them, and they may not display correctly when converted to other formats such as `.docx`.*

LINK STYLED AS A BUTTON

Adding arbitrary HTML attributes to an element using Pandoc’s attribute syntax:

Manubot Manubot Manubot Manubot Manubot. Manubot Manubot Manubot Manubot. Manubot Manubot Manubot. Manubot Manubot. Manubot.

Adding arbitrary HTML attributes to an element with the Manubot `attributes` plugin (more flexible than Pandoc’s method in terms of which elements you can add attributes to):

Manubot Manubot Manubot Manubot Manubot. Manubot Manubot Manubot Manubot. Manubot Manubot Manubot. Manubot Manubot. Manubot.

Available background colors for text, images, code, banners, etc:

white lightgrey grey darkgrey black lightred lightyellow lightgreen lightblue lightpurple red orange yellow green blue purple

Using the [Font Awesome](#) icon set:

✓ ? ★ 🔔 ⌛ ⋮

Light Grey Banner

useful for *general information* - manubot.org

Blue Banner

useful for *important information* - manubot.org

Light Red Banner

useful for *warnings* - manubot.org

Discussion

Plot of the actual and predicted bike counts with respect to month. Loaded from the latest version of image on GitHub.

Conclusion

References

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- [2] F. Lin, S. Wang, J. Jiang, W. Fan and Y. Sun, "Predicting public bicycle rental number using multi-source data," 2017 International Joint Conference on Neural Networks (IJCNN), Anchorage, AK, 2017, pp. 1502-1509, doi: 10.1109/IJCNN.2017.7966030.
- [3] J. Huang, X. Wang and H. Sun, "Central Station Based Demand Prediction in a Bike Sharing System," 2019 20th IEEE International Conference on Mobile Data Management (MDM), Hong Kong, Hong Kong, 2019, pp. 346-348, doi: 10.1109/MDM.2019.00-38.
- [4] <https://www.kaggle.com/hmavrodiev/london-bike-sharing-dataset>
- [5] Ashqar, H. I., Elhenawy, M., Rakha, H. A., Road, V. P., & Qld, K. G. "Case Studies on Transport Policy Modeling bike counts in a bike-sharing system considering the effect of weather conditions," 2019. Case Studies on Transport Policy, 7(2), 261–268. <https://doi.org/10.1016/j.cstp.2019.02.011>
- [6] F. Lin, S. Wang, J. Jiang, W. Fan and Y. Sun, "Predicting public bicycle rental number using multi-source data," 2017 International Joint Conference on Neural Networks (IJCNN), Anchorage, AK, 2017, pp. 1502-1509, doi: 10.1109/IJCNN.2017.7966030.

Referencing figures, tables, equations

Figure [21](#)

Figure [22](#)

Figure [23](#)

Figure [24](#)

Table [10](#)

Equation [9](#)

Equation [10](#)

Figures

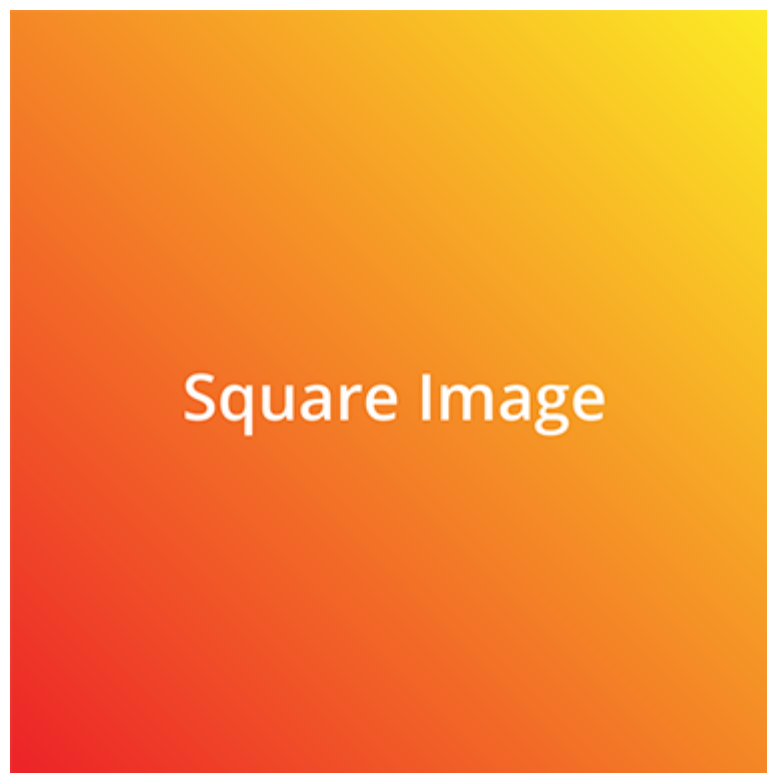


Figure 21: A square image at actual size and with a bottom caption. Loaded from the latest version of image on GitHub.

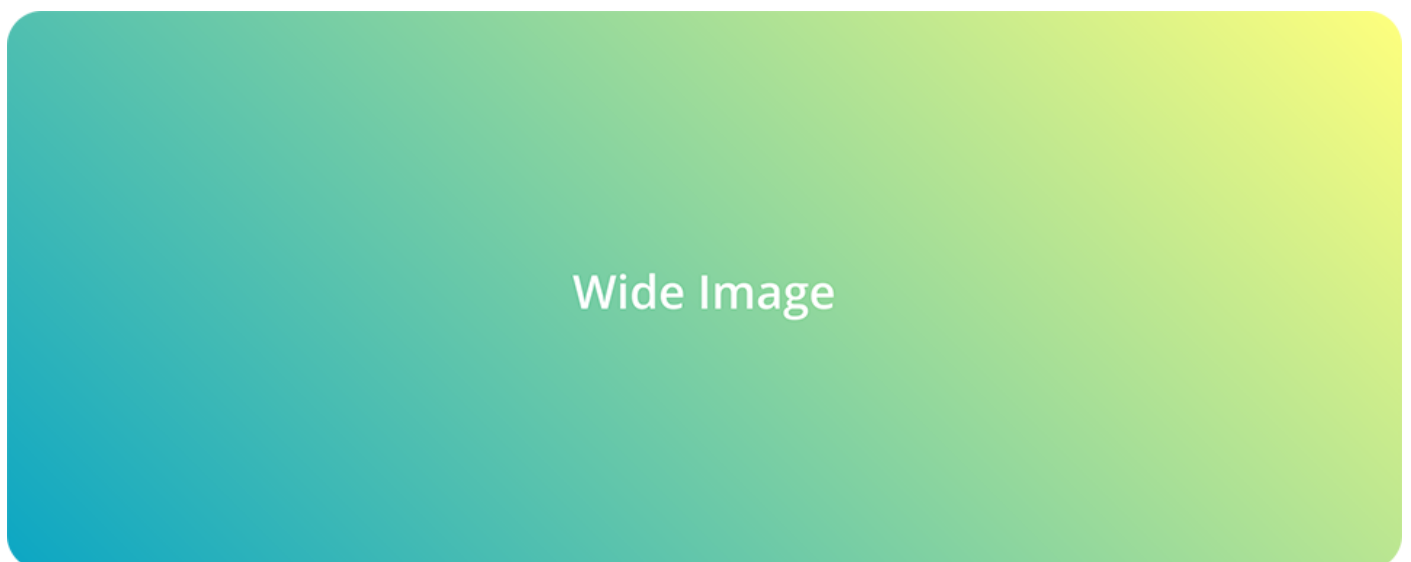


Figure 22: An image too wide to fit within page at full size. Loaded from a specific (hashed) version of the image on GitHub.



Figure 23: A tall image with a specified height. Loaded from a specific (hashed) version of the image on GitHub.



Figure 24: A vector `.svg` image loaded from GitHub. The parameter `sanitize=true` is necessary to properly load SVGs hosted via GitHub URLs. White background specified to serve as a backdrop for transparent sections of the image.

) |

Equations

A LaTeX equation:

$$\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2} \tag{9}$$

An equation too long to fit within page:

$$\begin{aligned} x = & a + b + c + d + e + f + g + h + i + j + k + l + m + n + o + p + q + r + s + t \\ & + u + v + w + x + y + z + 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 \end{aligned} \tag{10}$$

References

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