

CEE 492 Data Science Project - Swifties

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Abstract

Introduction

Road accidents are responsible for a significant number of injuries reported every year. According to World Health Organization (WHO), approximately 1.3 million people die each year as a result of road traffic crashes (June, 2022). In addition, road traffic crashes cost countries 3% of their gross domestic product (WHO, 2022). Consequently, understanding what influences these accidents on roads is of utmost importance. However, it is not easy to decide which exact conditions lead to these accidents. Different road, climate, vehicle and driver conditions affect the likelihood of a driver to be in a fatal/serious accident.

The ability of predicting in an accurate way the potential occurrence of crashes is a valuable contribution for road safety. In an approach vastly used in the literature, crash records' data are used for the development of crash prediction models, so that agencies can allocate investments to priority areas of the roadway network. However, given that the budget for infrastructure improvements is limited, adopting countermeasures for all facilities that crashes are potentially occurring is not financially feasible. Therefore, informing drivers about the potential safety risks is a way to proactively compensate the aforementioned limitations. Moreover, with the development of connected and autonomous vehicles, this information can be provided in a more optimized way, contributing for vehicles' route decision, as well as for real-time alerts that can lead drivers to take the necessary precautions to operate more safely.

Project Proposal and Objective

The objective of this work is to use the Illinois Department of Transportation (IDOT) extensive crashes' data to be analyzed and, finally, be used for a crash risk prediction model based on main categorical data that can be real-time updated (such as the weather/lighting/pavement conditions). Ideally, it could be used by navigation systems to alert drivers to adopt more cautious behavior as soon as they enter higher-risk sections.

Description of the Data Set

This is a statewide crash location dataset produced by the Crash Information Section of the Illinois Department of Transportation (IDOT). The accident data has been collected throughout the years using Application Programming Interfaces (APIs) that provided streaming traffic incident data. There are about 300,000 accident records per year in this dataset, and each of them contains the attributes including: 1. Time and date (day, month, year) 2. Coordinates (x,y) 3. Type of collision 4. A quantitative description of fatalities and injuries 5. Crash severity classification based on their impact on traffic 6. The road surface condition ("Dry", "Wet", "Snow or slush", "Ice", or "Sand/Dirt/Mud") 7. Road defects ("Debris on roadway", "Rut/Holes", "Unknown", or "No defects") 8. Light conditions (rated in a scale from 1 to 9) 9. Geometric characteristics of the road section 10. Work Zone ("construction", "maintenance", "utility", "unknown", or "N/A") 11. Possible causes of the accident.

References

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This manuscript is a template (aka “rootstock”) for [Manubot](#), a tool for writing scholarly manuscripts. Use this template as a starting point for your manuscript.

The rest of this document is a full list of formatting elements/features supported by Manubot. Compare the input (`.md` files in the `/content` directory) to the output you see below.

Basic formatting

Bold text

Semi-bold text

Centered text

Right-aligned text

Italic text

Combined *italics* and **bold**

~~Strikethrough~~

1. Ordered list item
2. Ordered list item
 - a. Sub-item
 - b. Sub-item
 - i. Sub-sub-item
3. Ordered list item
 - a. Sub-item

- List item
- List item
- List item

subscript: H₂O is a liquid

superscript: 2¹⁰ is 1024.

[unicode superscripts](#)⁰¹²³⁴⁵⁶⁷⁸⁹

[unicode subscripts](#)₀₁₂₃₄₅₆₇₈₉

A long paragraph of text. Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

Putting each sentence on its own line has numerous benefits with regard to [editing](#) and [version control](#).

Line break without starting a new paragraph by putting two spaces at end of line.

Document organization

Document section headings:

Heading 1

Heading 2

Heading 3

Heading 4

Heading 5

Heading 6

A heading centered on its own printed page

Horizontal rule:

Heading 1's are recommended to be reserved for the title of the manuscript.

Heading 2's are recommended for broad sections such as *Abstract*, *Methods*, *Conclusion*, etc.

Heading 3's and Heading 4's are recommended for sub-sections.

Links

Bare URL link: <https://manubot.org>

[Long link with lots of words and stuff and junk and bleep and blah and stuff and other stuff and more stuff yeah](#)

[Link with text](#)

[Link with hover text](#)

[Link by reference](#)

Citations

Citation by DOI [[1](#)].

Citation by PubMed Central ID [[2](#)].

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 [1](#)

Figure [2](#)

Figure [3](#)

Figure [4](#)

Table [1](#)

Equation [1](#)

Equation [2](#)

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 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.



Figure 3: A tall image with a specified height. Loaded from a specific (hashed) version of the image on GitHub.



Figure 4: 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 1: 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 2: 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 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:

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

(1)

An equation too long to fit within page:

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

(2)

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

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