Stream Mining

One-Hot Encoding and DGIM

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One-Hot Encoding

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- **categorical** features common

$x \in \{\text{red}, \text{green}, \text{blue}\}$

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$$x \in \{\text{red}, \text{green}, \text{blue}\} \longrightarrow x \in \{1, 2, 3\}$$

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One-Hot Encoding

- **categorical** features common
- need for numbers in algorithms
- naïve approach: number serially
  - danger of meaningless calculations
- **one-hot encoding**
  - one binary feature for each possible value

$$\begin{tikzcd} & x \in \{1, 2, 3\} \ ✗ \\ x \in \{\text{red}, \text{green}, \text{blue}\} \arrow[ur] \arrow[dr] & \\ & (x_{\text{red}}, x_{\text{green}}, x_{\text{blue}}) \in \{0, 1\}^3 \ ✓ \end{tikzcd}$$

The Datar-Gionis-Indyk-Motwani Algorithm

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sizes: 8	4		4	2		1	1	
. . . 1 0 1	1 0 1 1 0 0 0 1	0	1 1 1 0 1	1 0 0 1	0	1	1	0

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- **estimation**: half the size of the oldest bucket + sum of sizes of all other buckets
  - error rate: $\pm 50\%$
- needs only $\boldsymbol{\mathcal{O}((\log_2 N)^2)}$ **bits**

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- saved as CSV

```
p,x,s,n,t,p,f,c,n,k,e,e,s,s,w,w,p,w,o,p,k,s,u
e,x,s,y,t,a,f,c,b,k,e,c,s,s,w,w,p,w,o,p,n,n,g
e,b,s,w,t,l,f,c,b,n,e,c,s,s,w,w,p,w,o,p,n,n,m
...
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e,b,s,w,t,l,f,c,b,n,e,c,s,s,w,w,p,w,o,p,n,n,m
                         ...
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Are there simple rules to determine edibility?

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e,x,s,y,t,a,f,c,b,k,e,c,s,s,w,w,p,w,o,p,n,n,g
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...
```

Are there simple rules to determine edibility? **Yes!** (e.g. odour)

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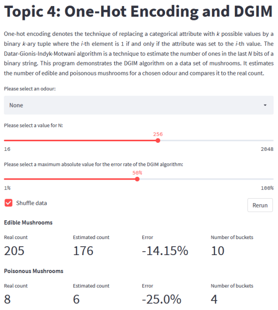
- **Streamlit** for the **interface**



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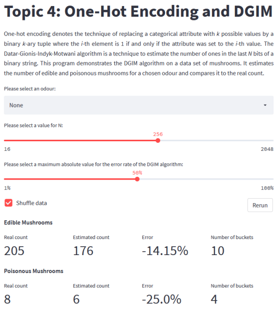

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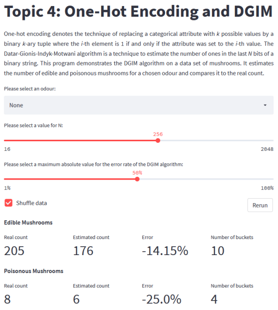
  - odour type



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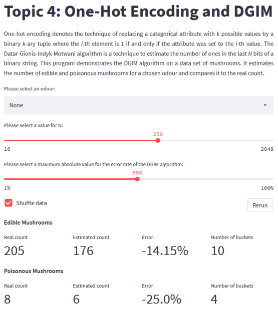

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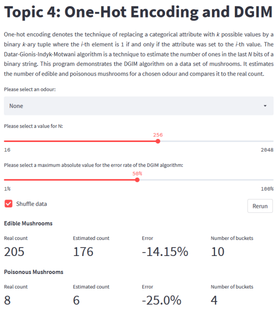

Please select an odour:

None

Please select a value for N:

256

16 2048

Please select a maximum absolute value for the error rate of the DGIM algorithm:

50%

1% 100%

Shuffle data

Rerun

Edible Mushrooms

Real count	Estimated count	Error	Number of buckets
214	208	-2.8%	10

Poisonous Mushrooms

Real count	Estimated count	Error	Number of buckets
11	12	9.09%	6

Please select an odour:

None

Please select a value for N:

2048

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Please select a maximum absolute value for the error rate of the DGIM algorithm:

50%

1% 100%

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Edible Mushrooms

Real count	Estimated count	Error	Number of buckets
1675	1872	11.76%	15

Poisonous Mushrooms

Real count	Estimated count	Error	Number of buckets
67	72	7.46%	9

Please select an odour:

None

Please select a value for N:

2048

16 2048

Please select a maximum absolute value for the error rate of the DGIM algorithm:

1%

1% 100%

Shuffle data

Rerun

Edible Mushrooms

Real count	Estimated count	Error	Number of buckets
1678	1672	-0.36%	410

Poisonous Mushrooms

Real count	Estimated count	Error	Number of buckets
68	68	0.0%	68

References

- Project code: `https://github.com/s9770652/DS1-DGIM`
- Mushroom data set: `https://archive-beta.ics.uci.edu/ml/datasets/mushroom`
- *Streamlit*: `https://streamlit.io/`
- Python package *dgim*: `https://pypi.org/project/dgim/`
- Description of one-hot encoding: `https://sherbold.github.io/intro-to-data-science/04_Data-Analysis-Overview.html#Features`
- Description of the DGIM algorithm (Section 4.6): `http://infolab.stanford.edu/~ullman/mmds/ch4.pdf`