

# DATA 3464: Fundamentals of Data Processing

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<< Long form title >>

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# Topic overview

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- Exploring categorical data
- Dealing with missing values
- Categorical data encoding strategies

## Resources used:

- [Feature Engineering Chapter 5](#)

# What is categorical data?

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- Samples can take on one of several discrete values or groups
  - **Nominal**: no particular order to the groups
  - **Ordinal**: groups relate to each other in a specific order
- Categories can be represented as strings *or* numeric types
  - Domain knowledge is necessary!

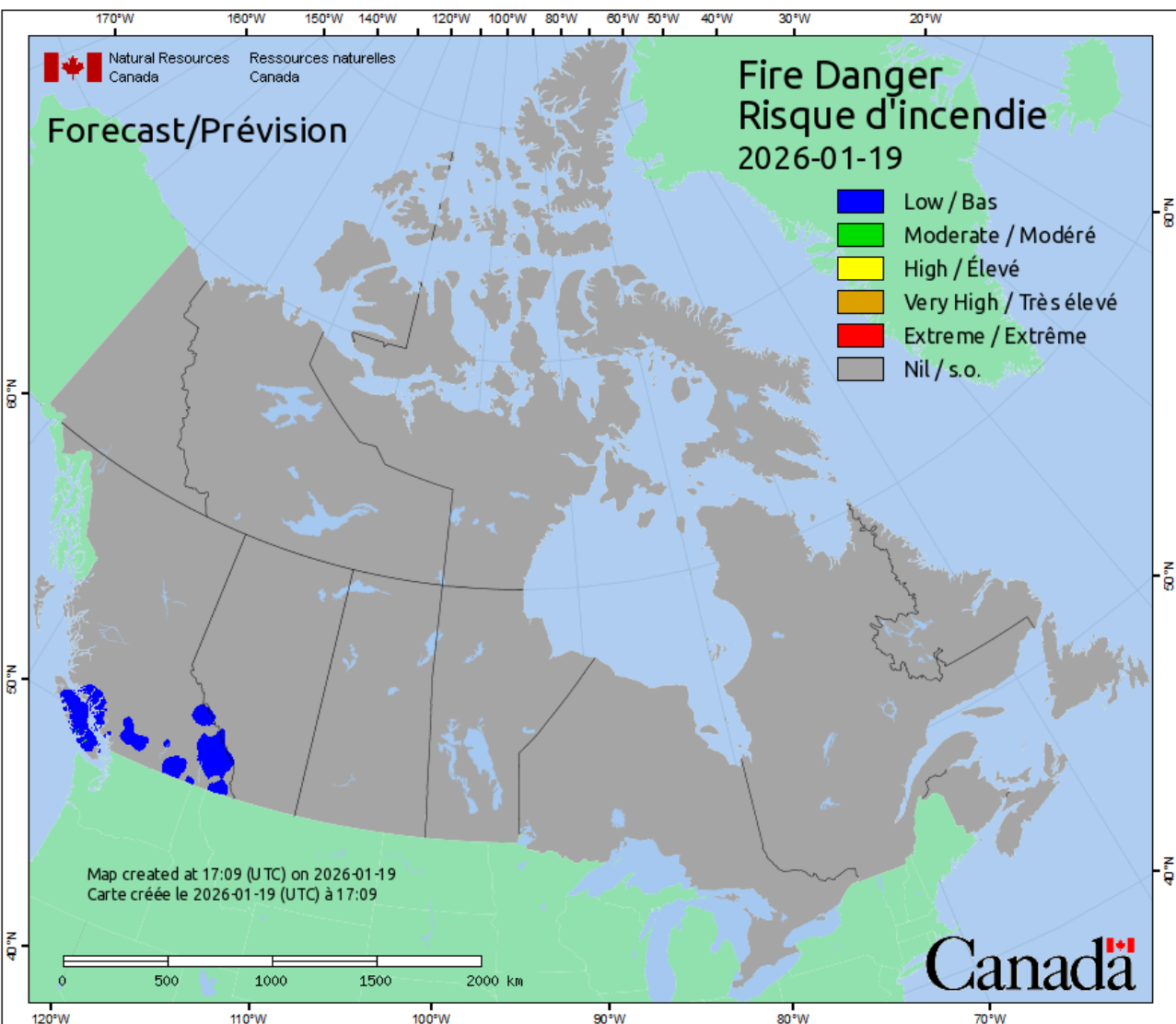
*Let's take a few minutes to brainstorm some examples*

# Representing categorical data

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- Tree-based models can handle string-based categories as-is
- Most other models need numbers
- Consider:
  - Ordinal or nominal?
  - How many possible categories?
  - Any chance new ones might show up?

*How could we encode the examples?*



# Ordinal encoding

Category	Feature
Nil	0
Low	1
Moderate	2
High	3
Very High	4
Extreme	5

# Nominal categories: one-hot encoding

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- Categories have no natural relationship
- Create  $k$  new features from  $k$  categories, very sparse matrix

Animal		cat	dog	rabbit
cat	→	1	0	0
dog	→	0	1	0
rabbit	→	0	0	1

*What kinds of problems could occur with this encoding scheme?*

# Another approach: target encoding

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- Basic concept: replace the category with the mean of the target
- Essential to avoid data leakage!
- Example: predicting weight of animal

Animal		mean_kg
cat	→	4.1
dog	→	15.4
rabbit	→	2.2

# Getting fancy

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- Feature hashing or the "hash trick"
- Good if you have too many categories, or combinations of categories
- Converts each category into a fixed-length feature vector

<b>Animal</b>		<b>A_0</b>	<b>A_1</b>	<b>A_2</b>	<b>...</b>	<b>A_16</b>
cat	→	1	0	0	...	1
dog	→	0	1	0	...	1
rabbit	→	1	0	1	...	0



# Missing values in categorical data

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