DATA 3464: Fundamentals of Data Processing

<< Long form title >>

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Topic overview

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

Resources used:

- Feature Engineering Chapter 5

What is categorical data?

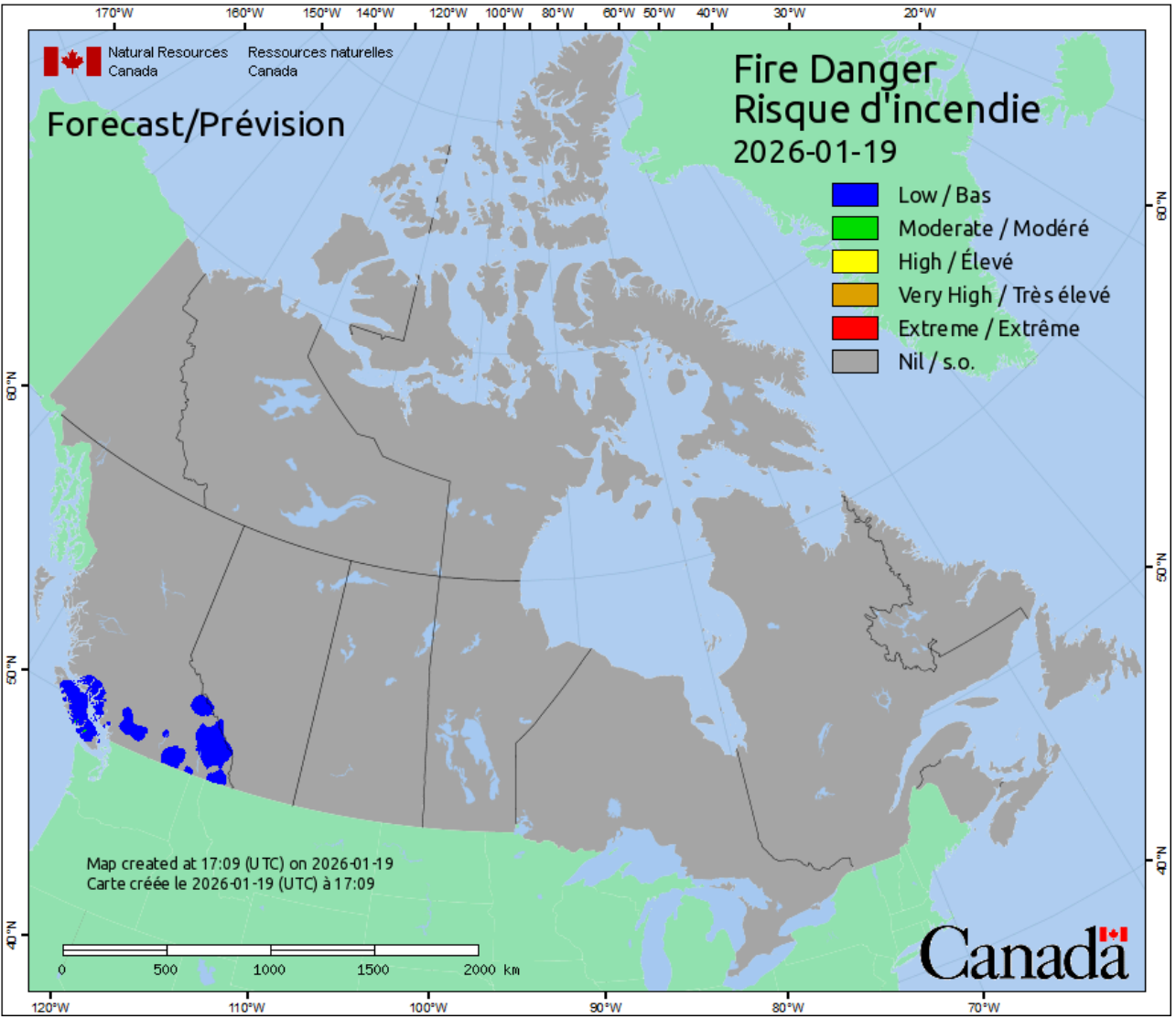
- Samples can take on one of several discrete values or groups
  - **Nominal**: no particular order to the groups
  - **Ordinal**: groups relate to each other in a specific order
- Categories can be represented as strings *or* numeric types
  - Domain knowledge is necessary!

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

Representing categorical data

- 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

Image source: Natural Resources Canada

Nominal categories: one-hot encoding

- 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

- 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

- 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

Animal		**A_0**	**A_1**	**A_2**	**...**	**A_16**
cat	→	1	0	0	...	1
dog	→	0	1	0	...	1
rabbit	→	1	0	1	...	0

Missing values in categorical data