

Deep Spectral Exploration

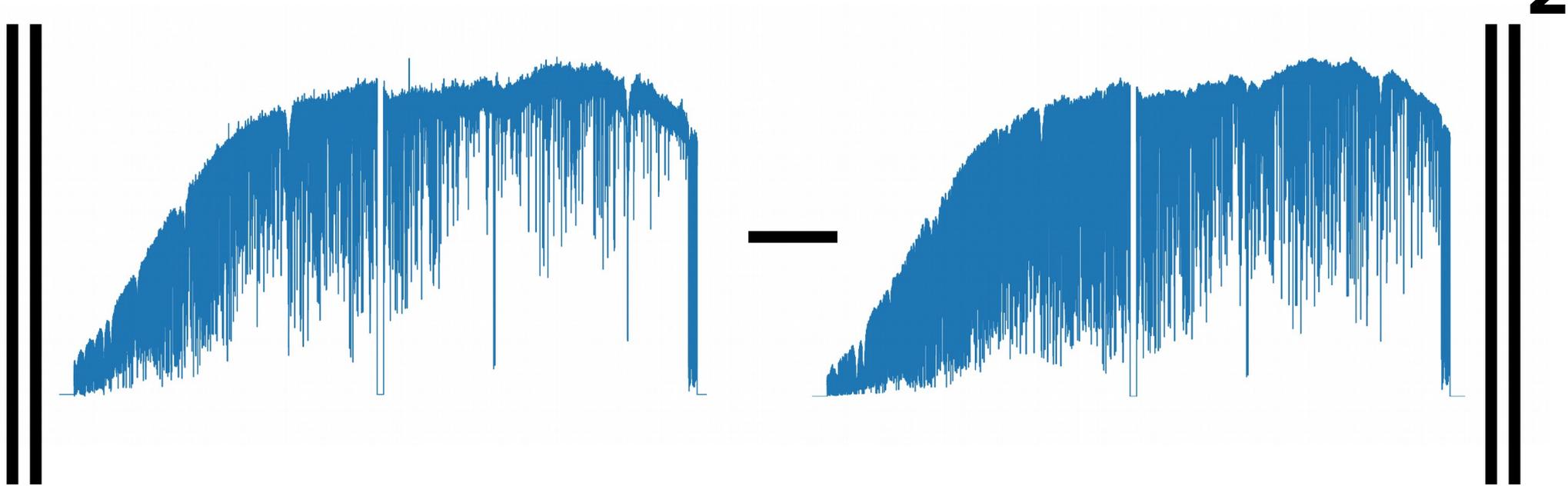
while letting the data speak for itself!

Nima Sedaghat et al. (@ ESO)

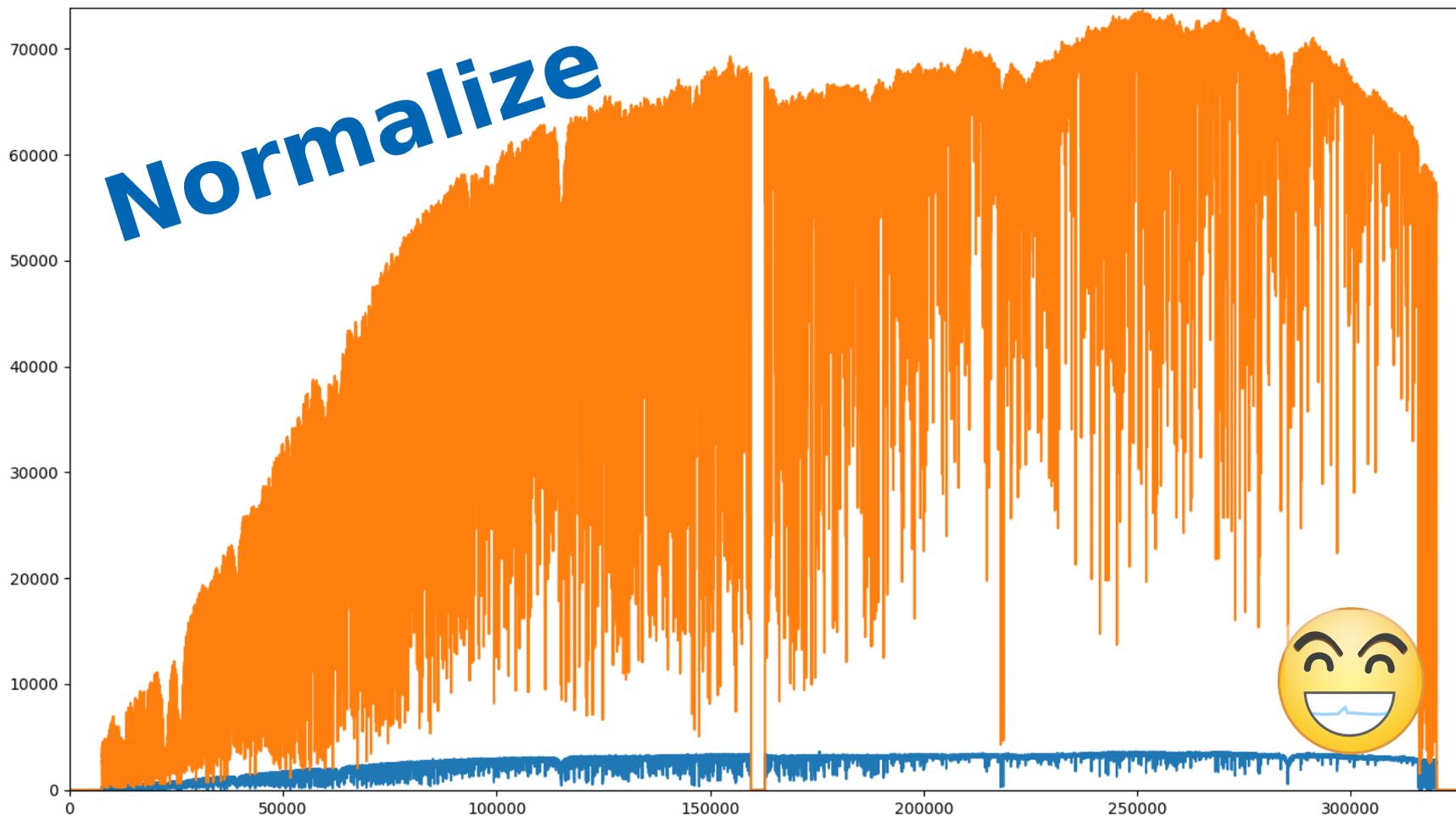
Overview

- **Motive: High-Resolution Search for Similarities**
- **Idea: Analysis of Information Content through Compression**
- **Learning from (BIG) Data: Telluric Lines**
- **RETR-SPECT: A Retrieval Engine for Spectra**

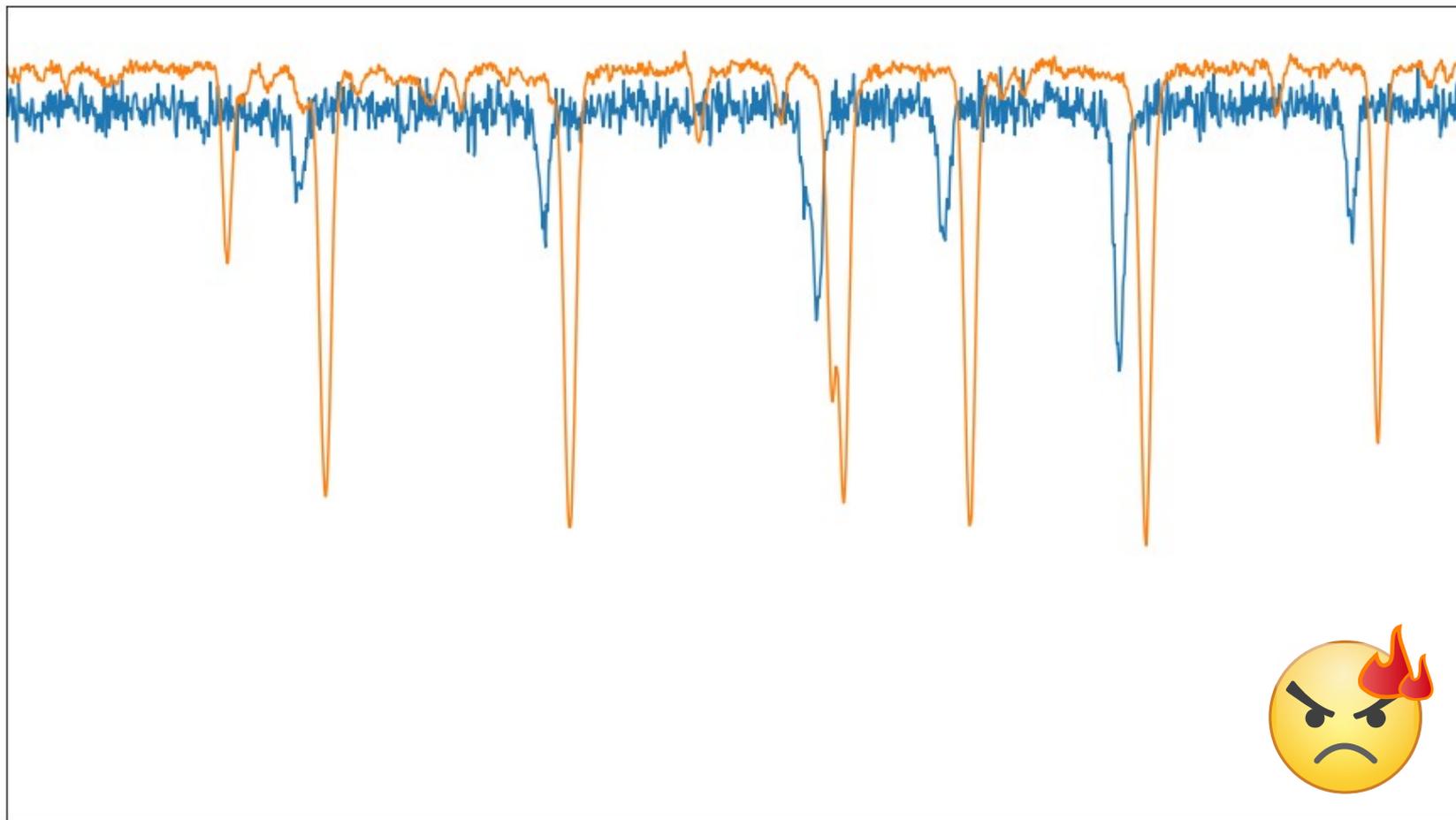
Motive: High-Resolution Search for Similarities



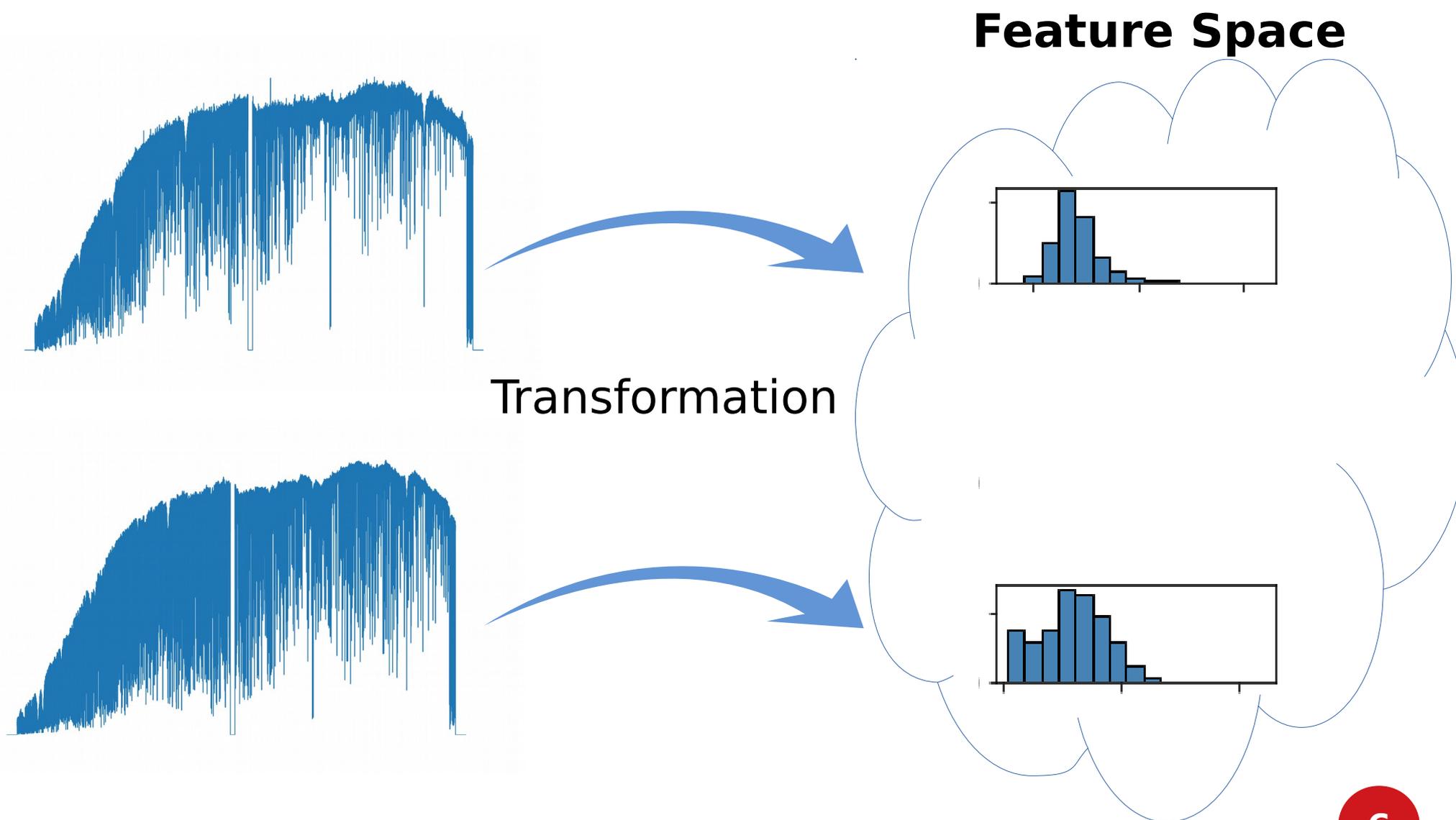
Motive: High-Resolution Search for Similarities



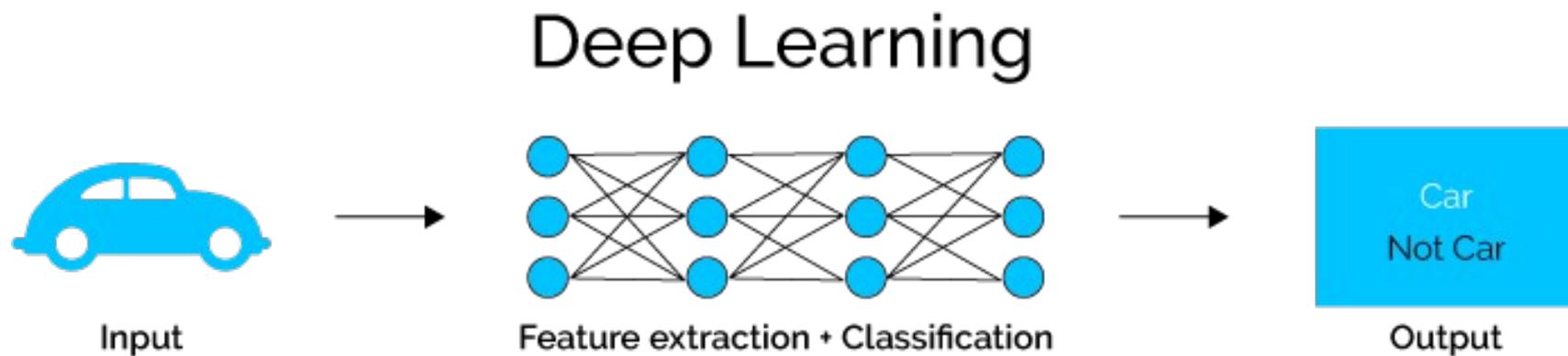
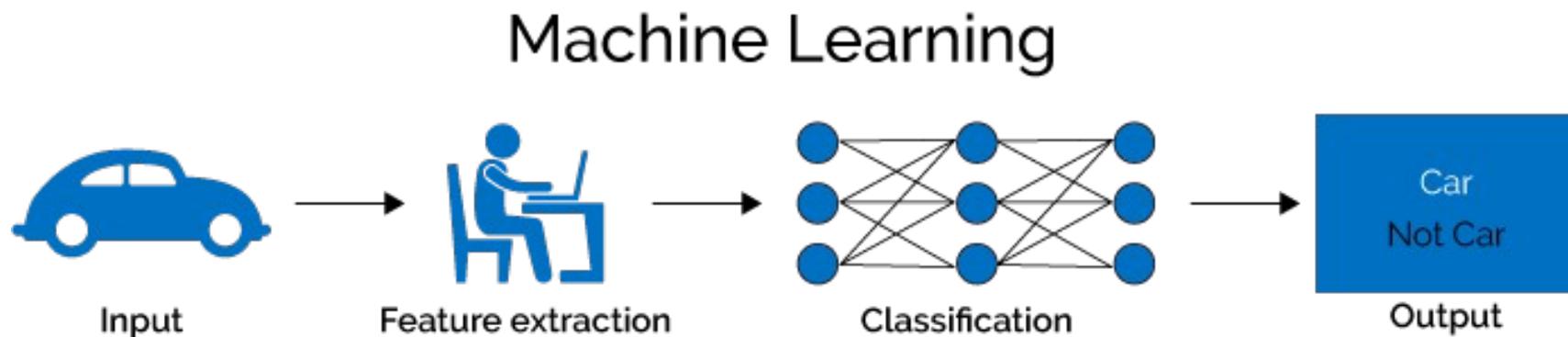
Motive: High-Resolution Search for Similarities



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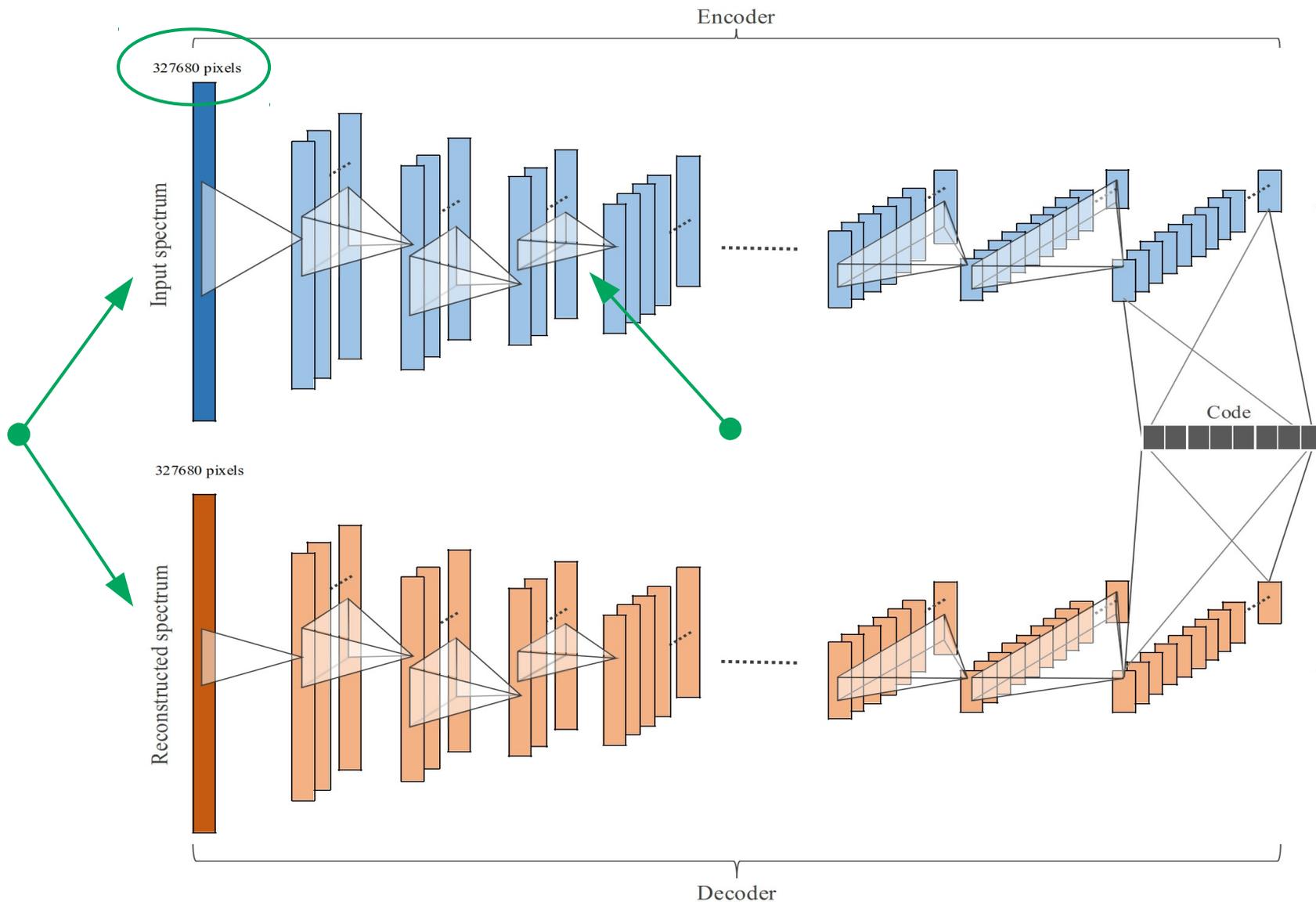
Deep Neural Networks for Feature Extraction



The Transformer



[https://michaelbaystransformers.fandom.com/wiki/Onslaught_\(ROTF\)](https://michaelbaystransformers.fandom.com/wiki/Onslaught_(ROTF))



Analysis of Information Content through Compression

Latent Space Dimensionality (= Code Size)

4

8

32

128

1024

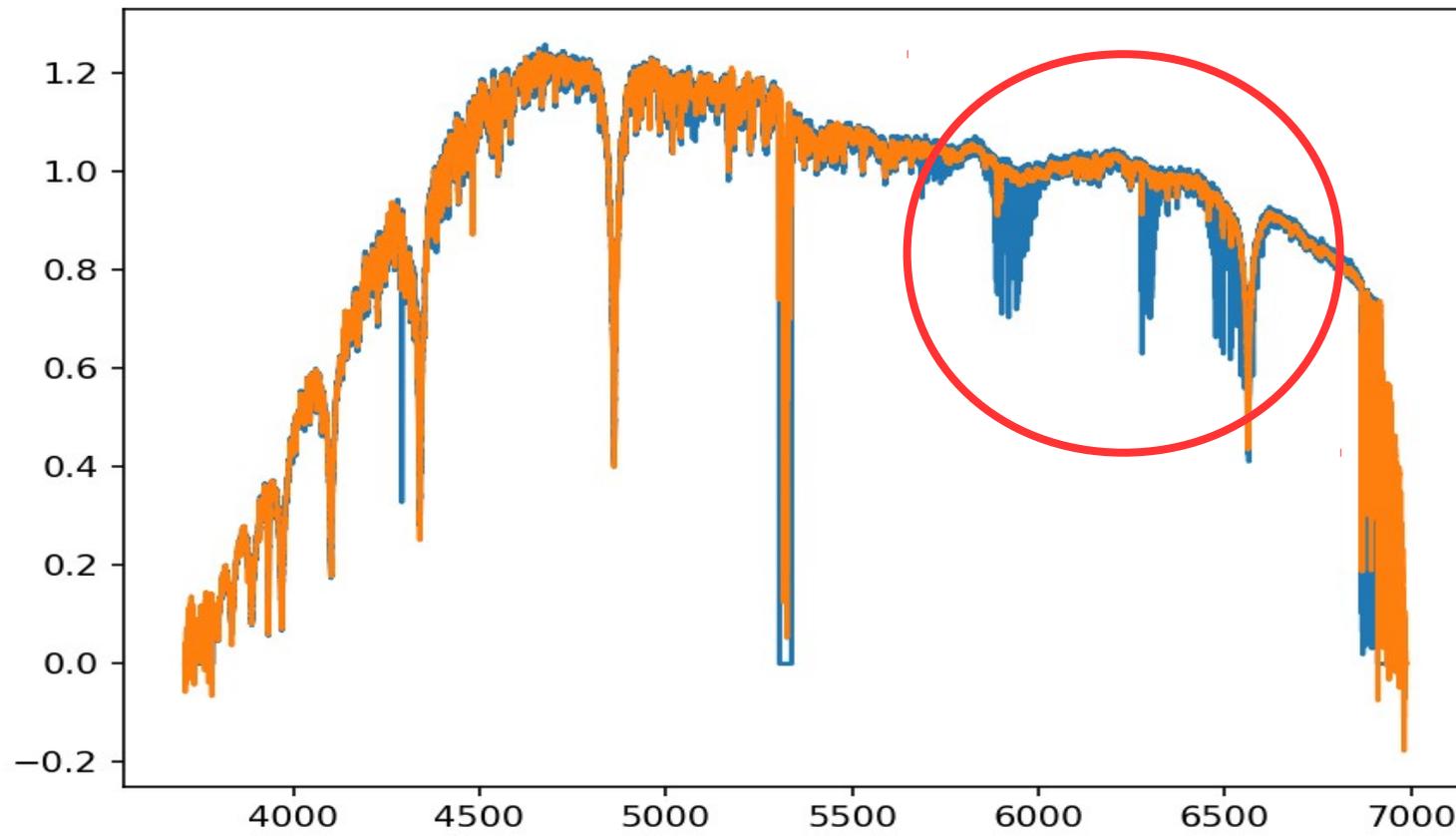
8192

In other words...

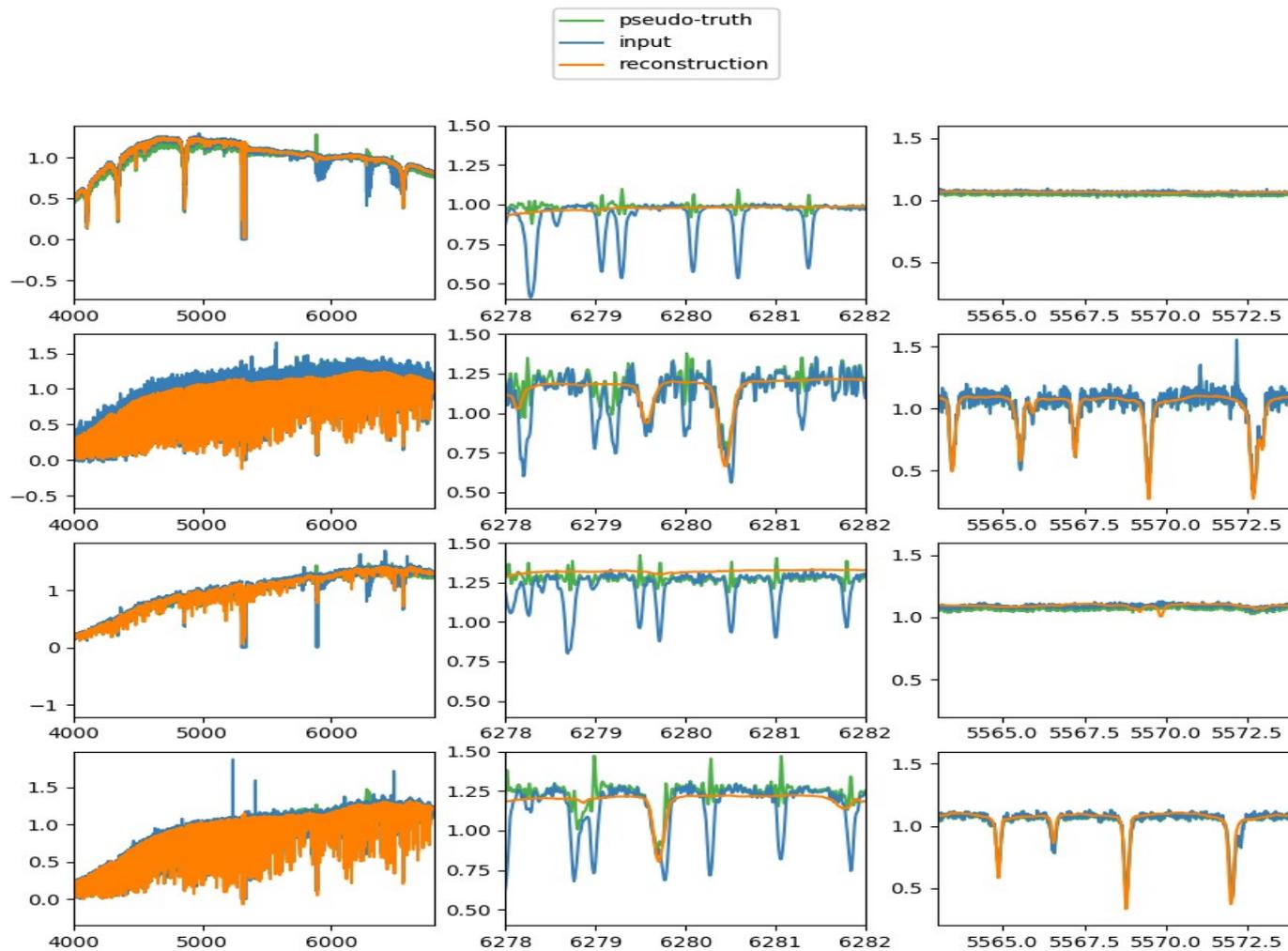


“If you don't reveal some insights soon, I'm going to be forced to slice, dice, and drill!”

It really learns semantics!



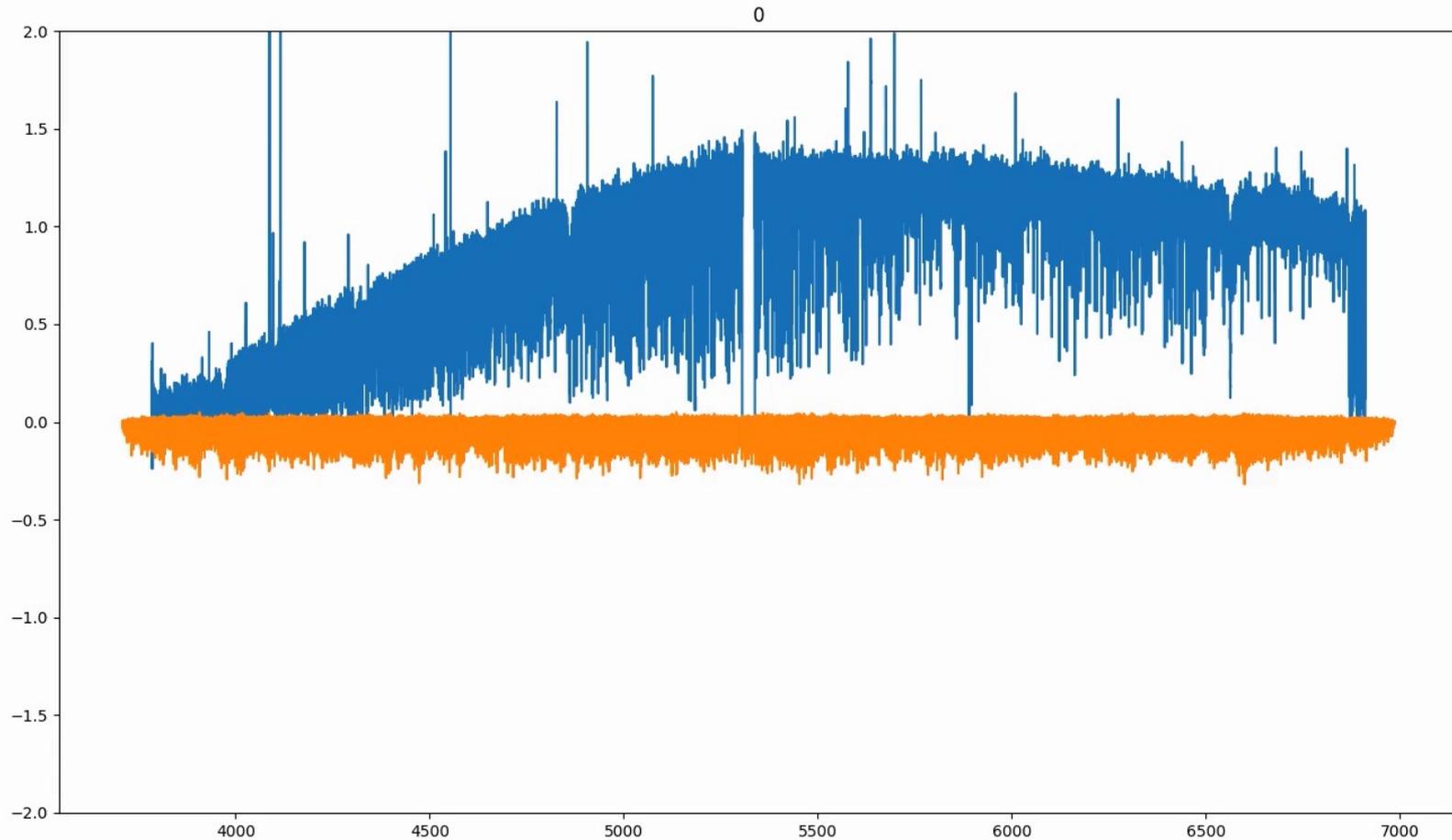
“if” vs. “how”



The data has spoken

(It seems that) non-inherently-stellar sources are separable from stellar spectra by looking at a huge number of them!

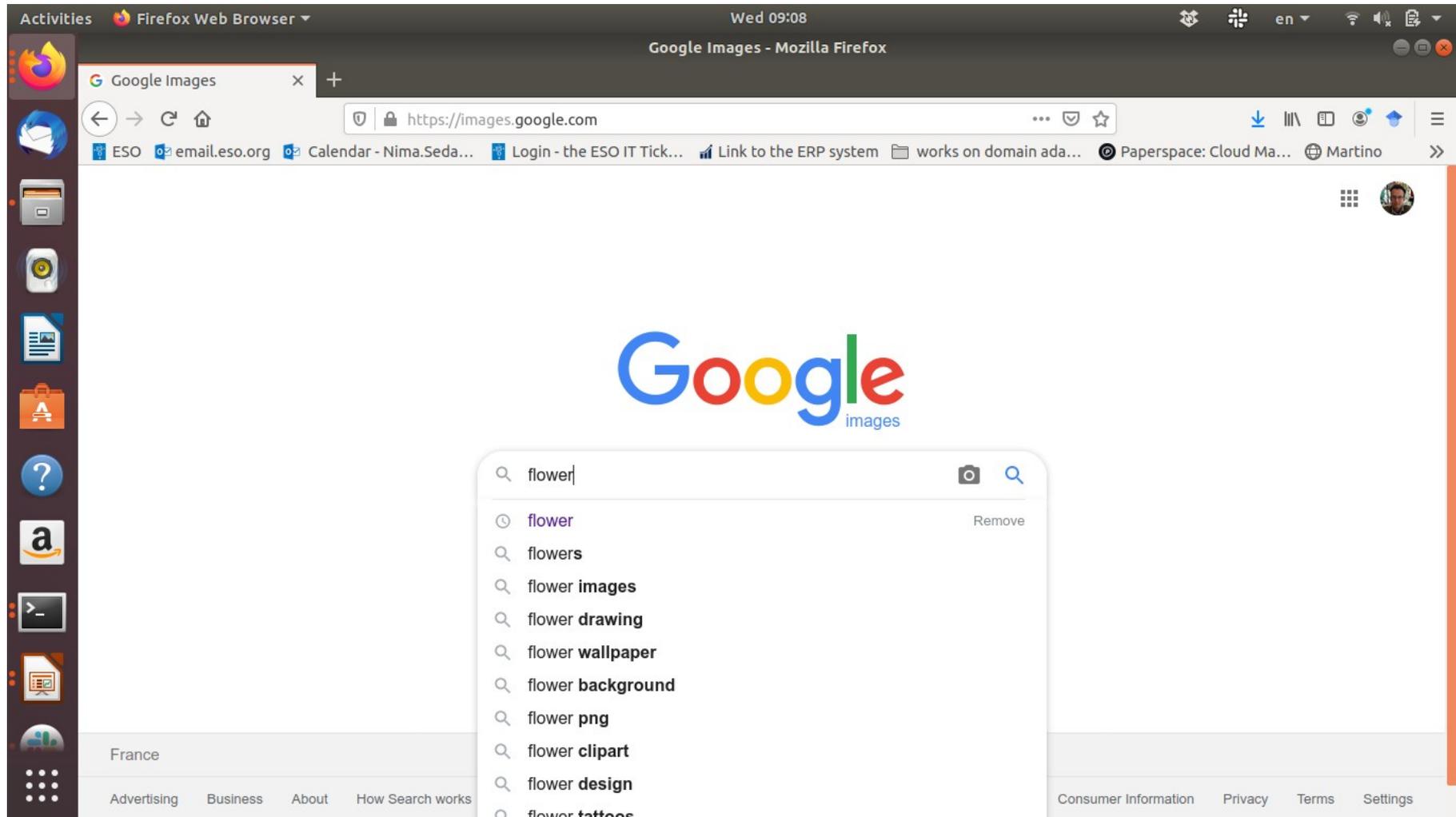
How does the learning happen?



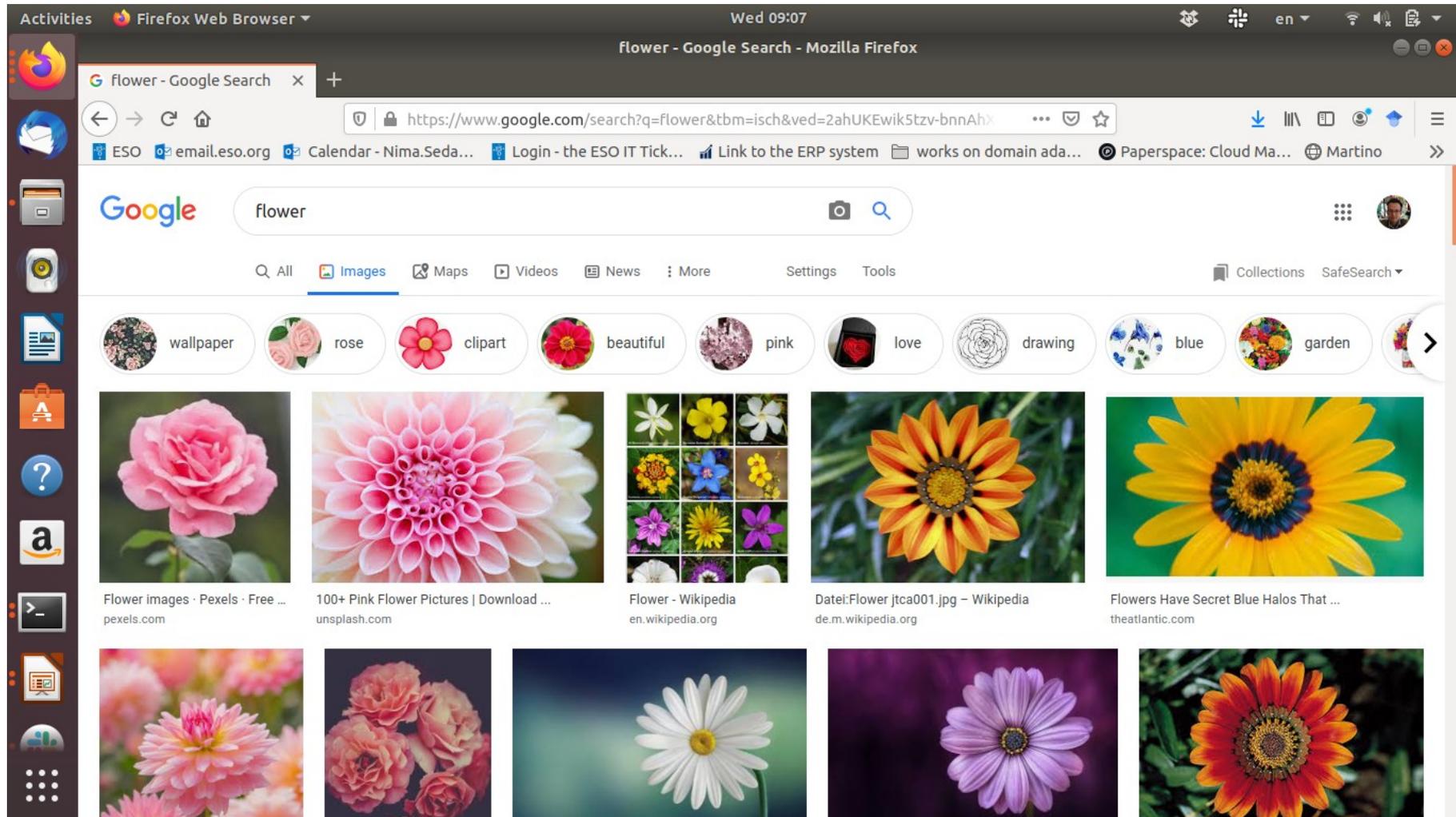
What is the nature of the learned features?



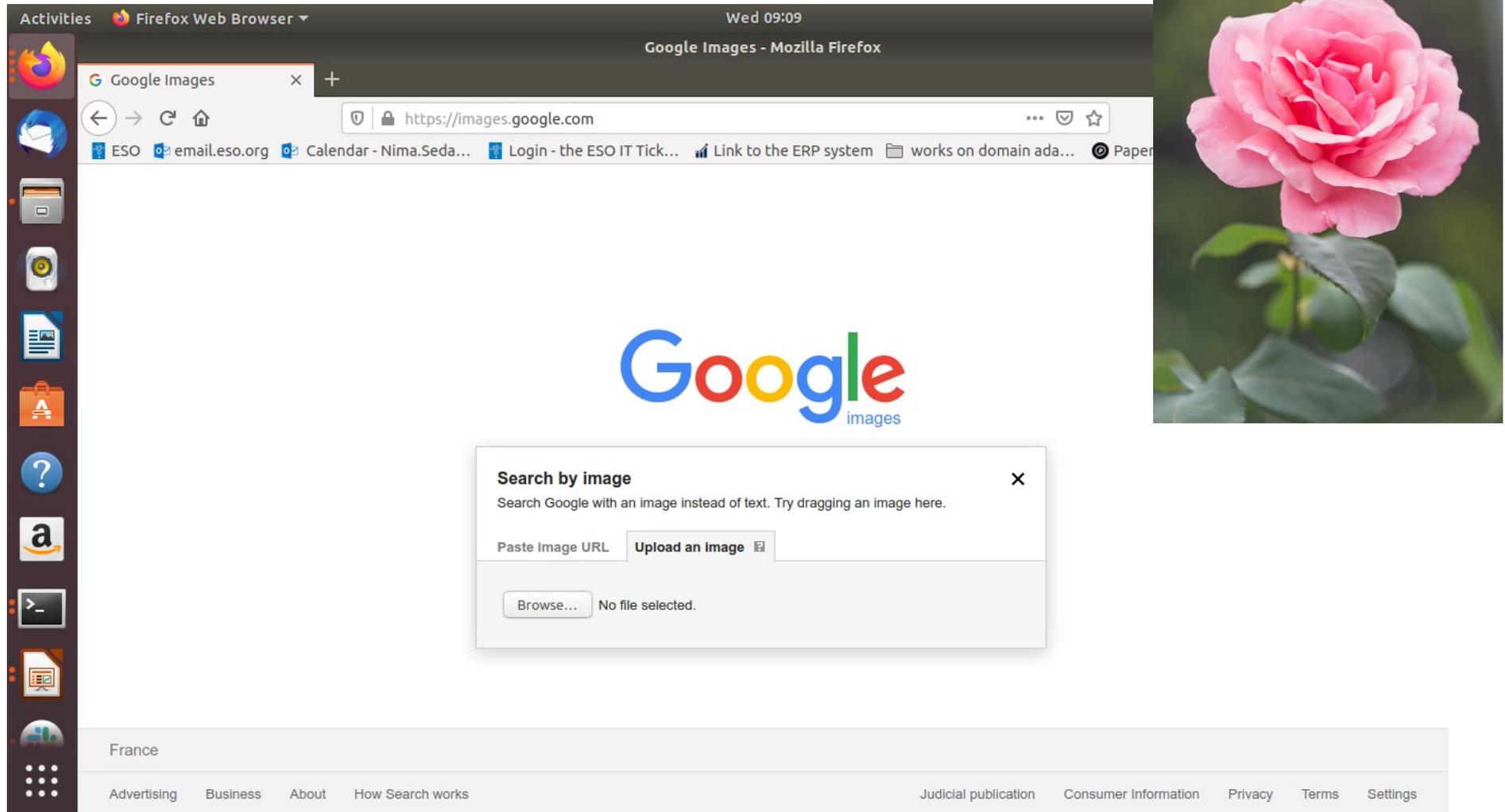
Information Retrieval



Information Retrieval

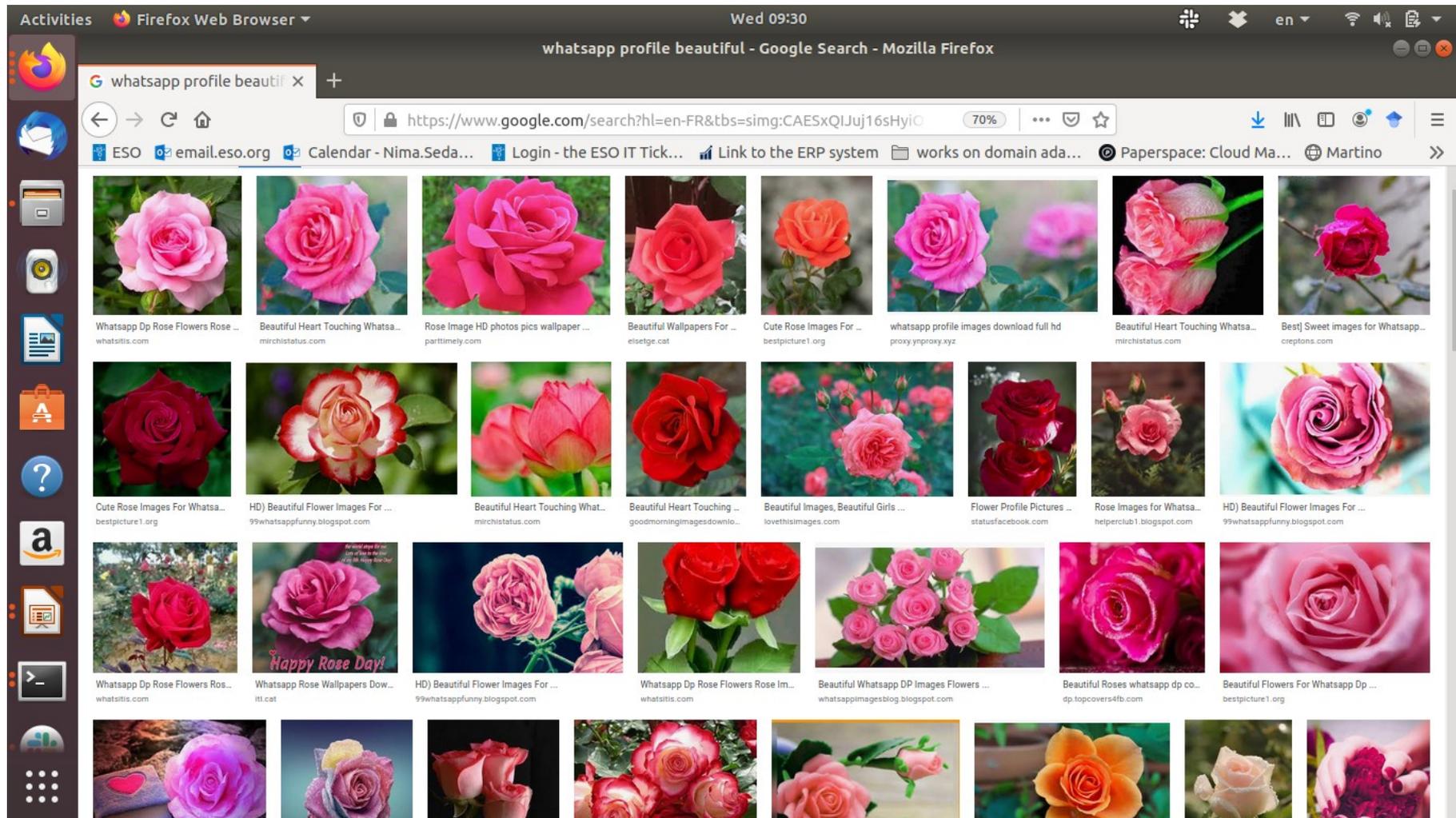


Information Retrieval

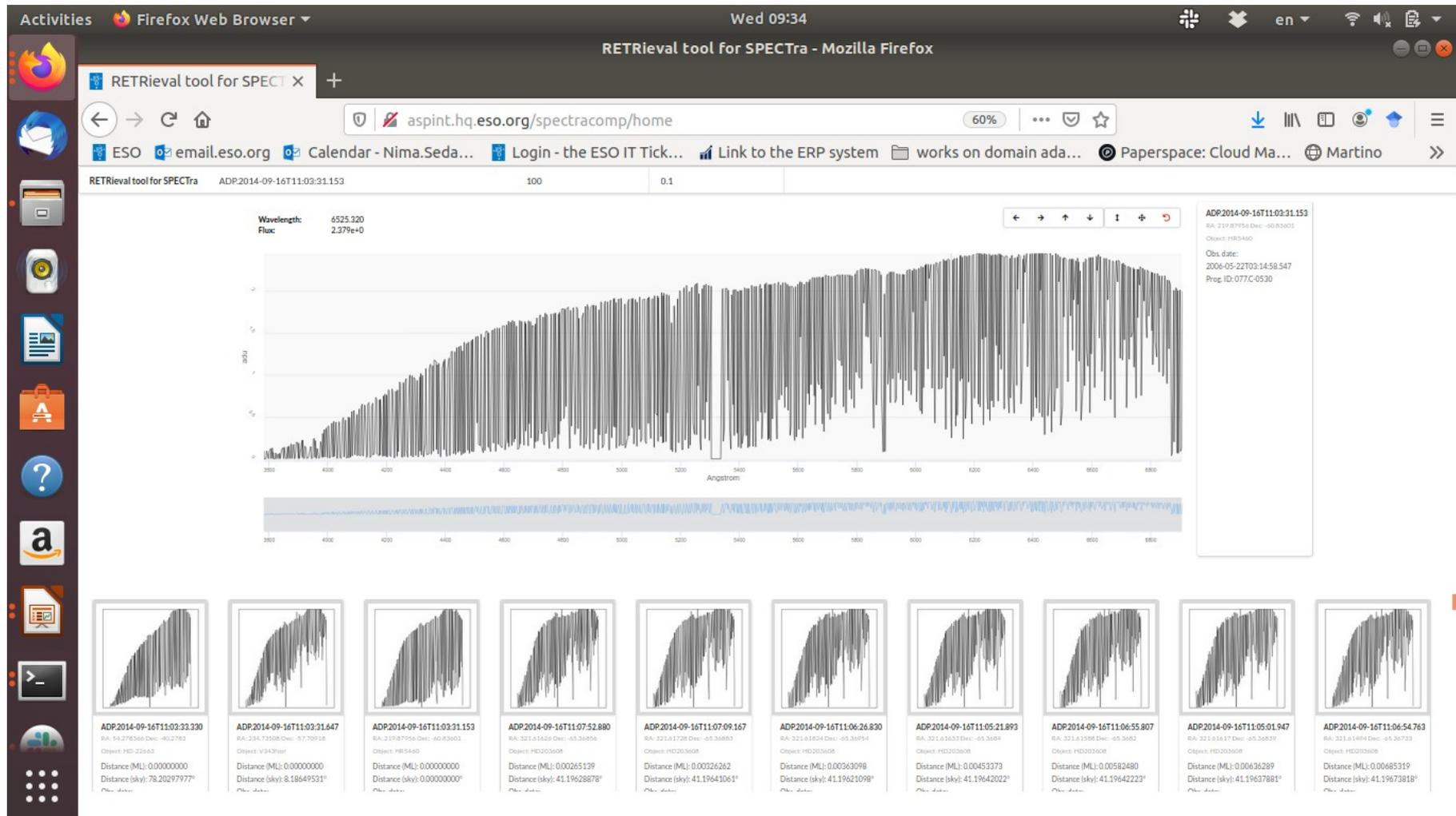


The screenshot displays a Firefox browser window with the Google Images search page. The browser's title bar reads "Google Images - Mozilla Firefox" and the address bar shows "https://images.google.com". A "Search by image" dialog box is open, featuring a close button (X) and instructions: "Search Google with an image instead of text. Try dragging an image here." The dialog has two tabs: "Paste Image URL" and "Upload an image". The "Upload an image" tab is active, showing a "Browse..." button and the text "No file selected." To the right of the browser window, there is a separate image of a pink rose.

Information Retrieval



RETR-SPECT: Retrieval engine for Spectra



Future

- Making the learned features interpretable (in progress)
- Imposing physics into the latent space
- Cross-dataset similarity search

Thank you for your attention