Explainable AI

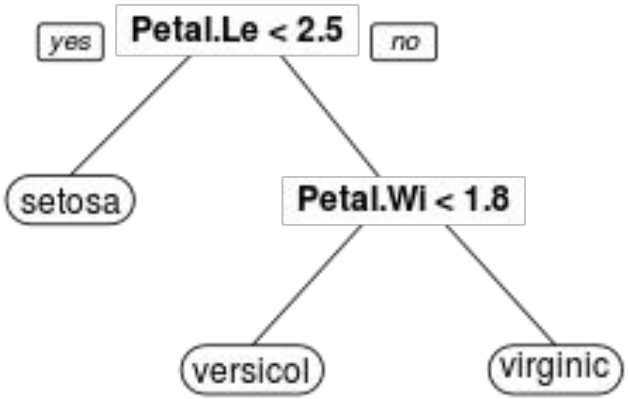
How to explain the decision of a machine learning algorithm?

Christoph Molnar

The problem

- Opaque decision making by machine learning algorithms
- Examples: AI doctor, self-driving cars, creditworthiness
- Trust as a user: Should I start severe therapy, because the machine said so?
- Debugging as a practitioner: Why did the algorithm miss-classify sample X? Did it learn generalizable features?

Keep it simple

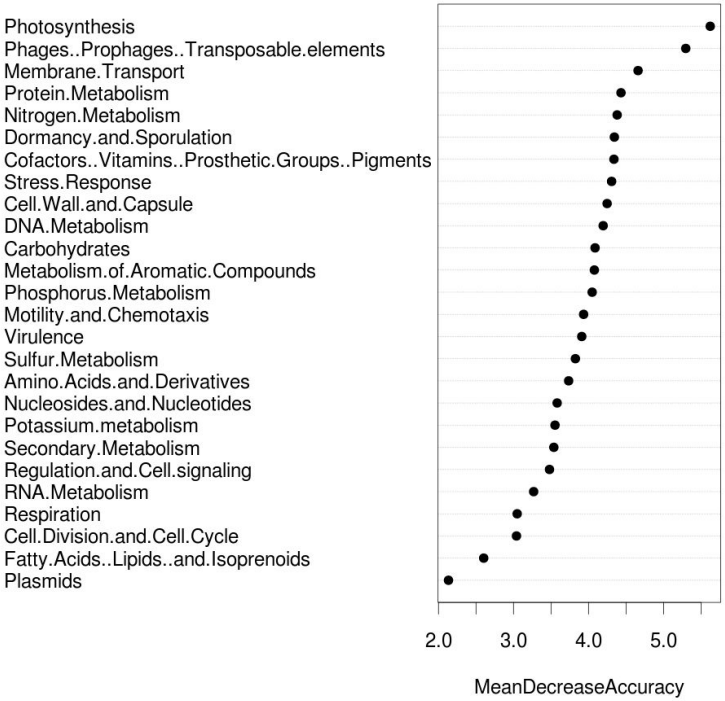


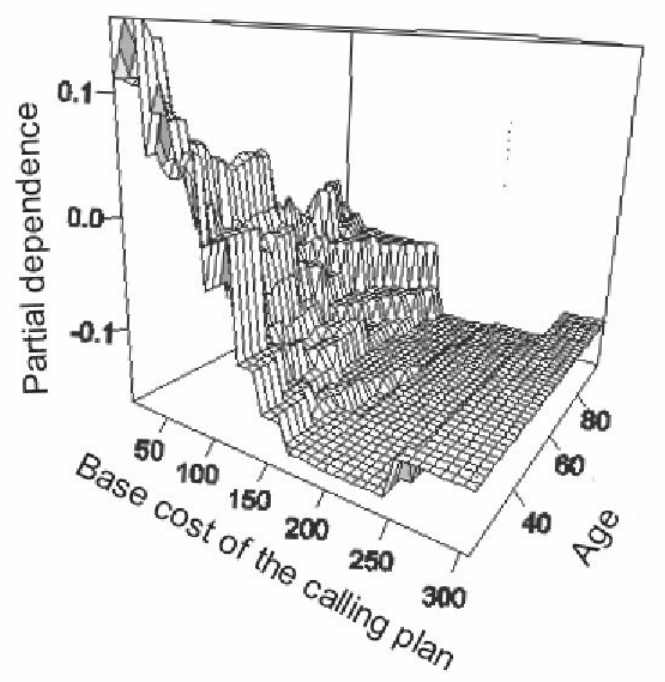
if irregular **then** *malignant* (80%)
else if spiculated **then** *malignant* (95%)
else if age> 57 **and** ill-defined **then** *malignant* (70%)
else if lobular **and** low density **then** *benign* (57%)
else *benign* (88%)

Letham, B., Rudin, C., Tyler, M., Mccormick, H., & Madigan, D. (2012). Building Interpretable Classifiers with Rules using Bayesian Analysis.

$$Y = \beta_0 + \beta_1 \cdot x_1 + \beta_2 \cdot x_2 + \ldots$$

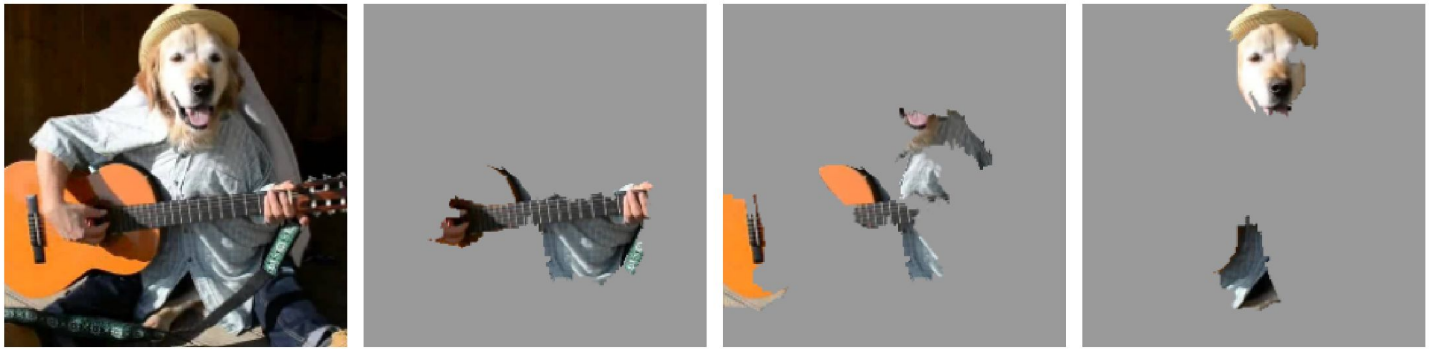
Analyse the system





Explain single decisions

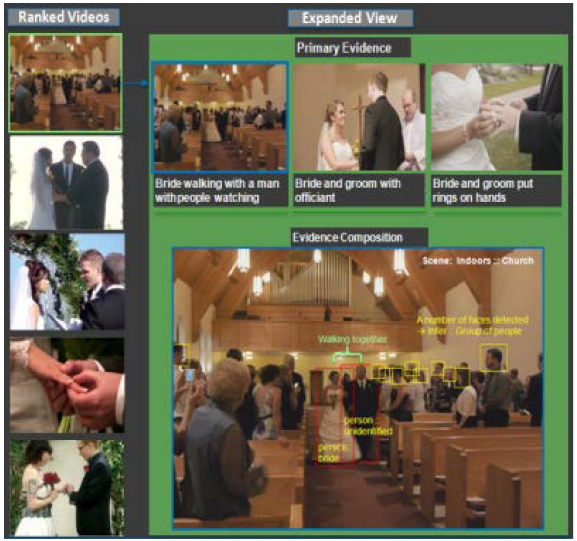
Local Interpretable Model-agnostic Explanations (LIME) [1]



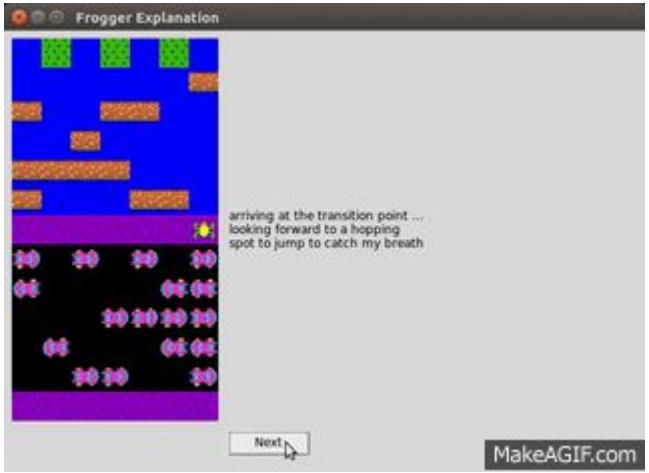
(a) Original Image (b) Explaining *Electric guitar* (c) Explaining *Acoustic guitar* (d) Explaining *Labrador*

Figure 4: Explaining an image classification prediction made by Google's Inception network, highlighting positive pixels. The top 3 classes predicted are "Electric Guitar" ($p = 0.32$)**, "Acoustic guitar"** ($p = 0.24$) **and "Labrador"** ($p = 0.21$)

Let algorithm explain



[2]



[3]

*This is a **White Pelican** because...*

Description: this bird is white and black in color with a long curved beak and white eye rings.

Explanation: this is a large white bird with a **long neck** and a **large orange beak**.

[4]

References

[1] Ribeiro, M. T., Singh, S., & Guestrin, C. (2016). “Why Should I Trust You?”: Explaining the Predictions of Any Classifier. Retrieved from http://arxiv.org/abs/1602.04938

[2] Cheng, H., Liu, J., Chakraborty, I., Chen, G., Liu, Q., Elhoseiny, M., … Curtis, J. (n.d.). Multimedia Event Detection and Recounting.

[3] https://www.youtube.com/watch?v=vXcuLEBwXsQ

[4] Hendricks, L. A., & Donahue, J. (n.d.). Generating Visual Explanations.

[5] DARPA-BAA-16-53. (2016). Explainable Artificial Intelligence (XAI). Defense Advanced Research Projects Agency, 1. Retrieved from http://www.darpa.mil/program/explainable-artificial-intelligence