How Machine Learning Works

GETTING TO KNOW MACHINE LEARNING

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$$L = -\frac{1}{m}\sum(y \cdot \log(\hat{y}) + (1-y) \cdot \log(1-\hat{y}))$$

$$softmax(l_i) = \frac{e^{l_i}}{\sum e^{l}}$$

$$\frac{\partial \mathrm{L}}{\partial \mathrm{b}} = \frac{1}{\mathrm{m}}\sum 2((wx + \mathrm{b}) - y)$$

$$\sigma(z) = \frac{1}{1 + e^{-z}}$$


do not open
danger

We want to
remove the magic.

What You Need

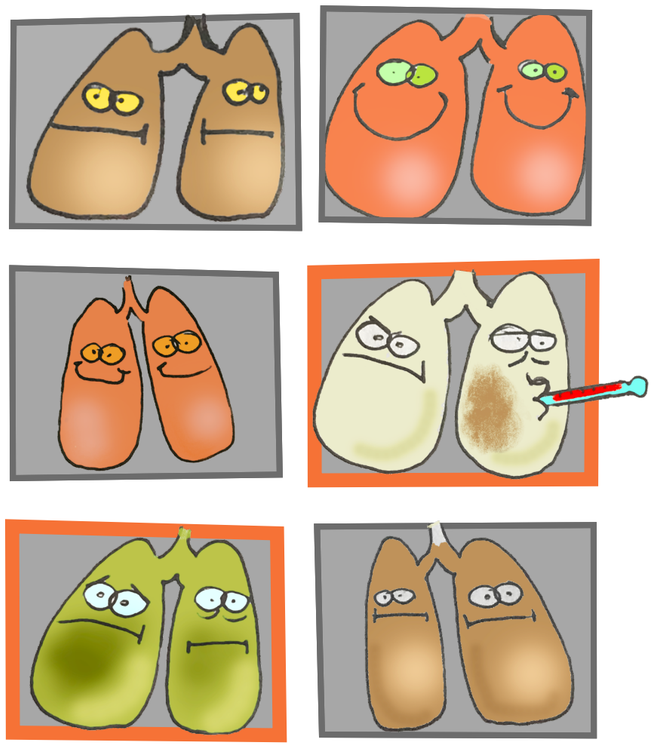
Know how to code

Know some high school math

...and that's it!

Programming vs. Machine Learning

Impossible Mission: A Pneumonia Detector



Center for Artificial Intelligence in Medicine & Imaging

The AIMI Center

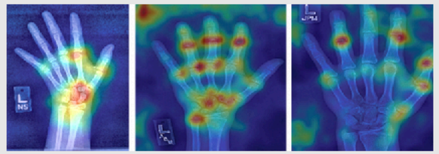
Stanford has established the AIMI Center to develop, evaluate, and disseminate artificial intelligence systems to benefit patients. We conduct research that solves clinically important imaging problems using machine learning and other AI techniques.

More about us »

Welcome from the Director Curtis Langlotz, MD, PhD

Machine learning provides an unprecedented opportunity to extract meaning from medical imaging data

2019 AIMI Seed Grant Awards



The AIMI Seed Grant program seeks to stimulate and support the creation of innovative and high-impact ideas that will advance the fields of medicine & imaging. Seven exciting and innovative proposals have been selected for the 2019 AIMI Seed Grant Program based on their scientific merit, potential clinical impact, and alignment with

Recent News and Media

Jun 7 2019 | Stanford News

AI Tools Help Radiologists Detect Brain Aneurysms

Jun 5 2019 | Stanford Engineering Magazine

AI could help radiologists interpret mammograms more accurately

May 31 2019

Curtis Langlotz, MD, PhD interviews with Brian Casey from AuntMinnie.com at the RSNA AI Spotlight Course

See more news »

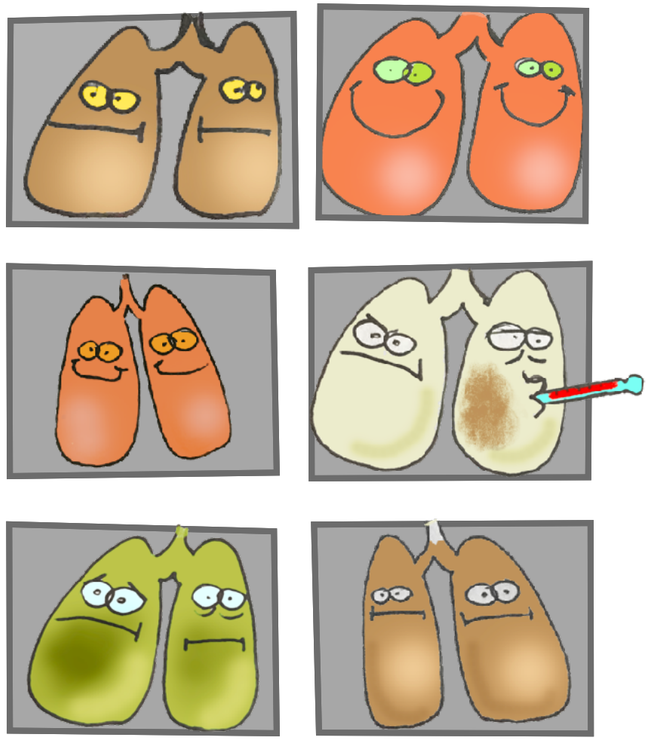
Programming

```
opaque_areas = identify_opaque_areas()
if opaque_areas > 0:
  pneumonia_likelihood = 0
  for area in opaque_areas:
    pneumonia_likelihood = likelihood(area.shape())
  if pneumonia_likelihood > 0.5:
    …
```

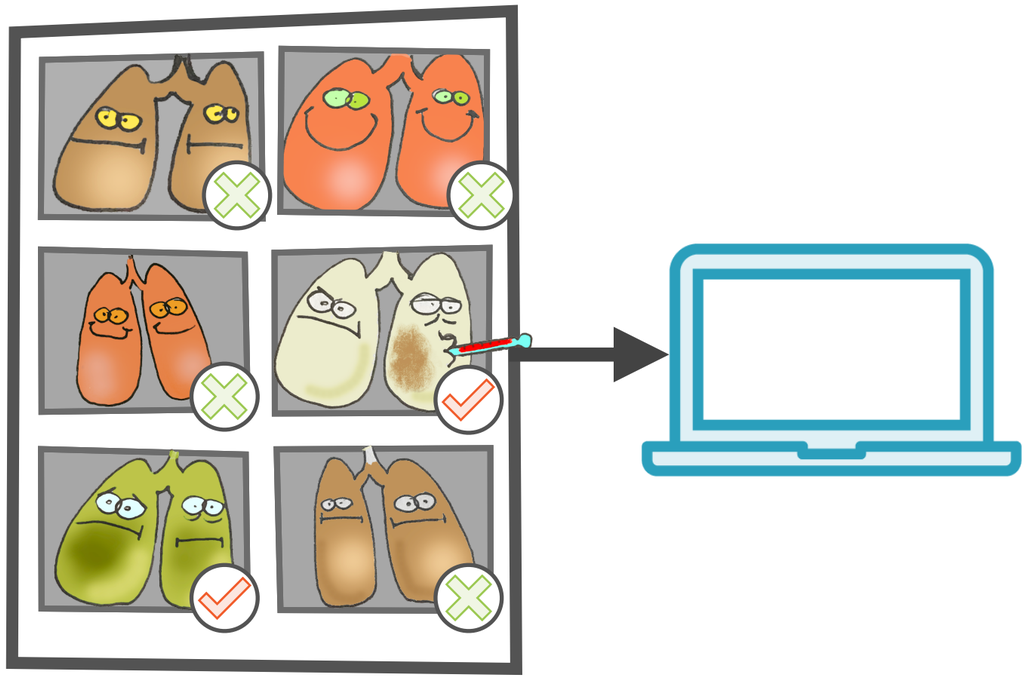
Machine Learning

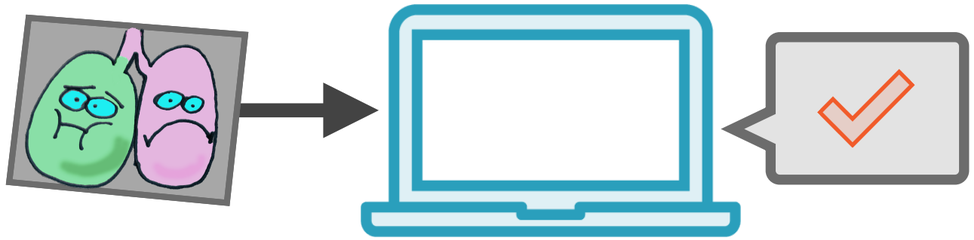
Supervised Learning

Start with Examples



The Two Phases of Supervised Learning





Training Phase

Get labeled examples, understand their patterns

Prediction Phase

Get unlabeled examples, predict their label

Supervised Learning Can Learn the Relation Between...

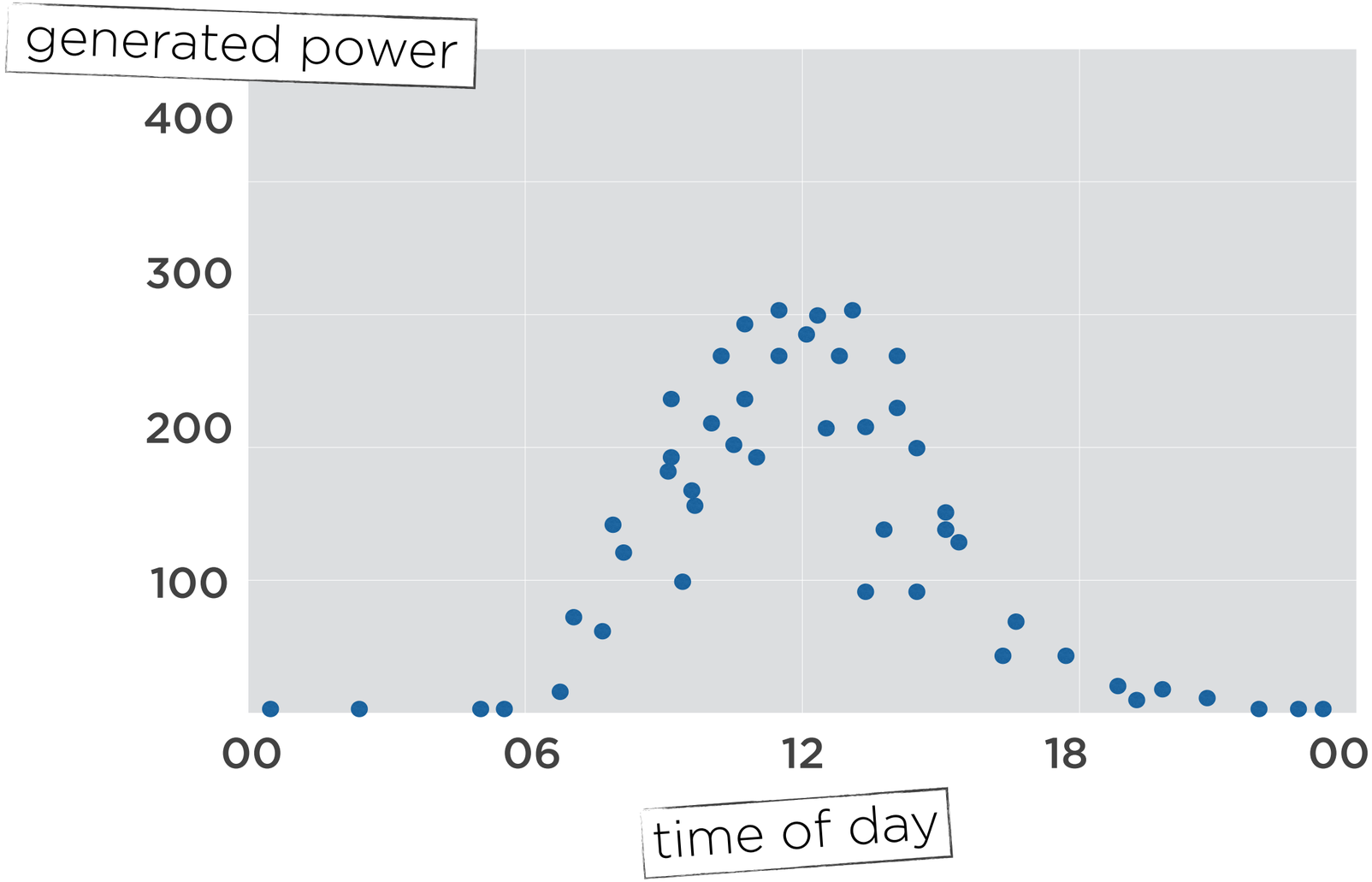
X	Y
An x-ray scan	Whether the scan shows pneumonia
Day of the year	Number of hot dogs sold
English text	Hindi text
...	...

Approximating a Function

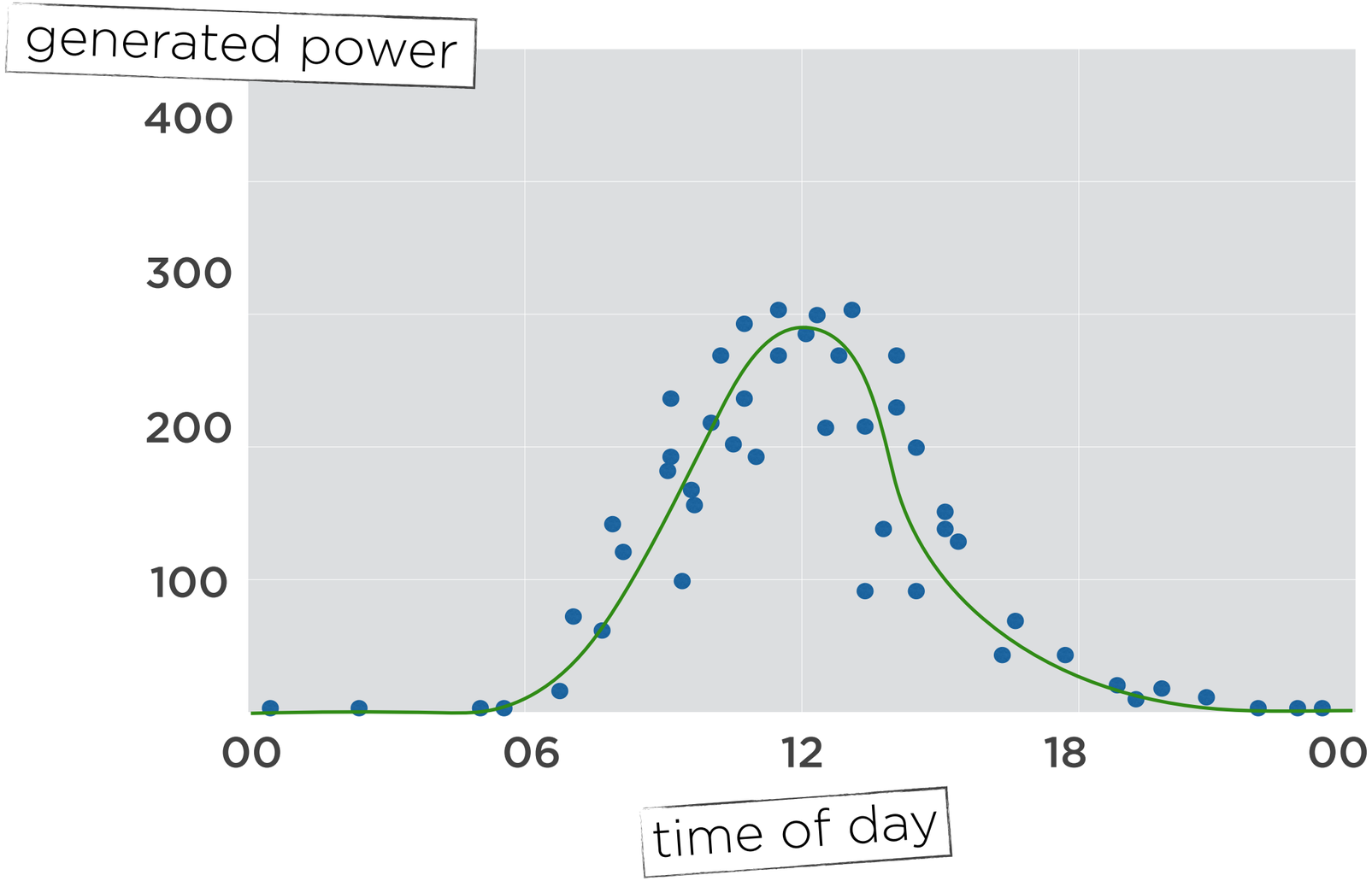
Supervised Learning Can Learn the Relation Between...

X	Y
Time of day	**Power generated by a solar panel**

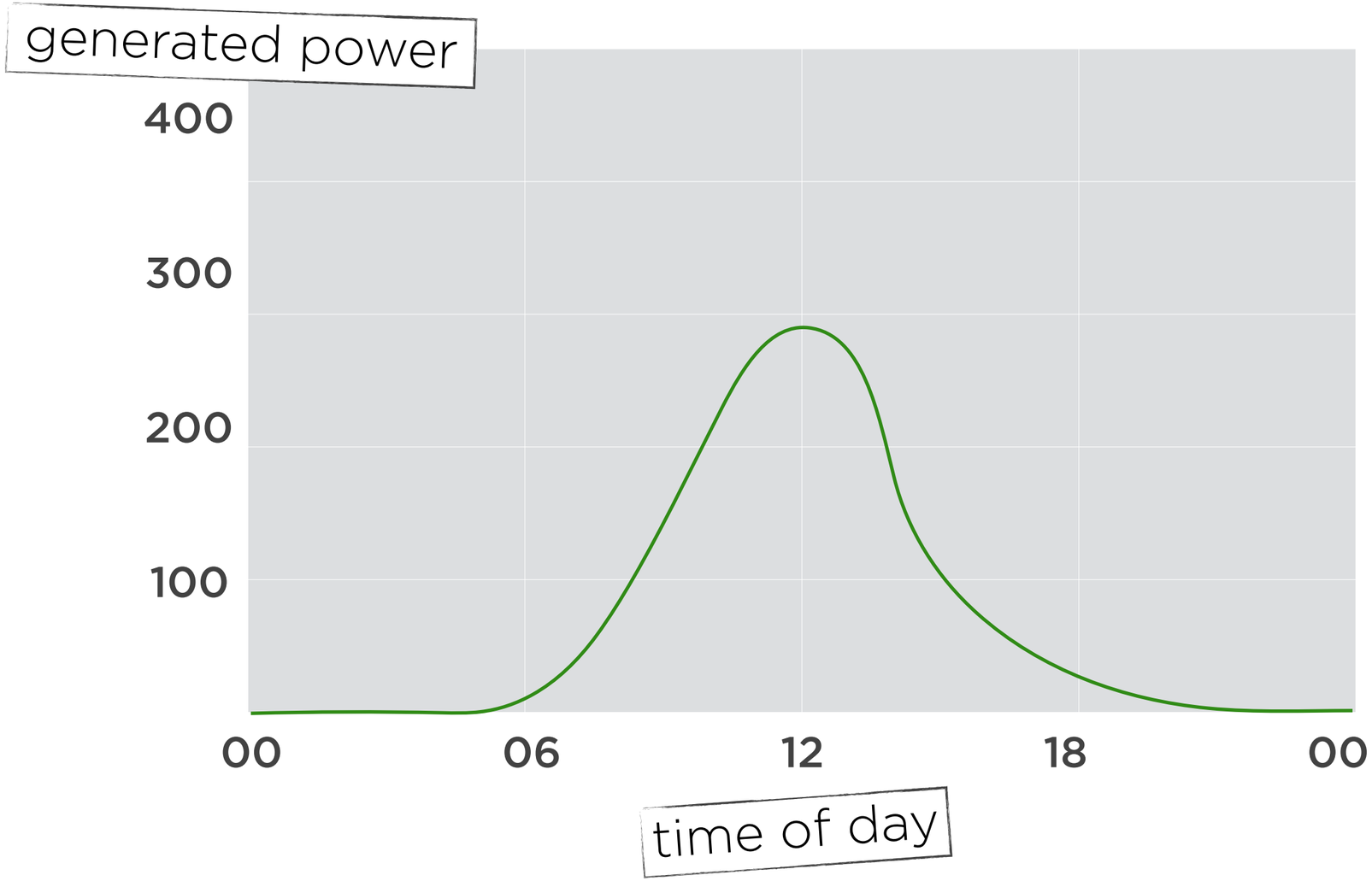
How Supervised Learning Works



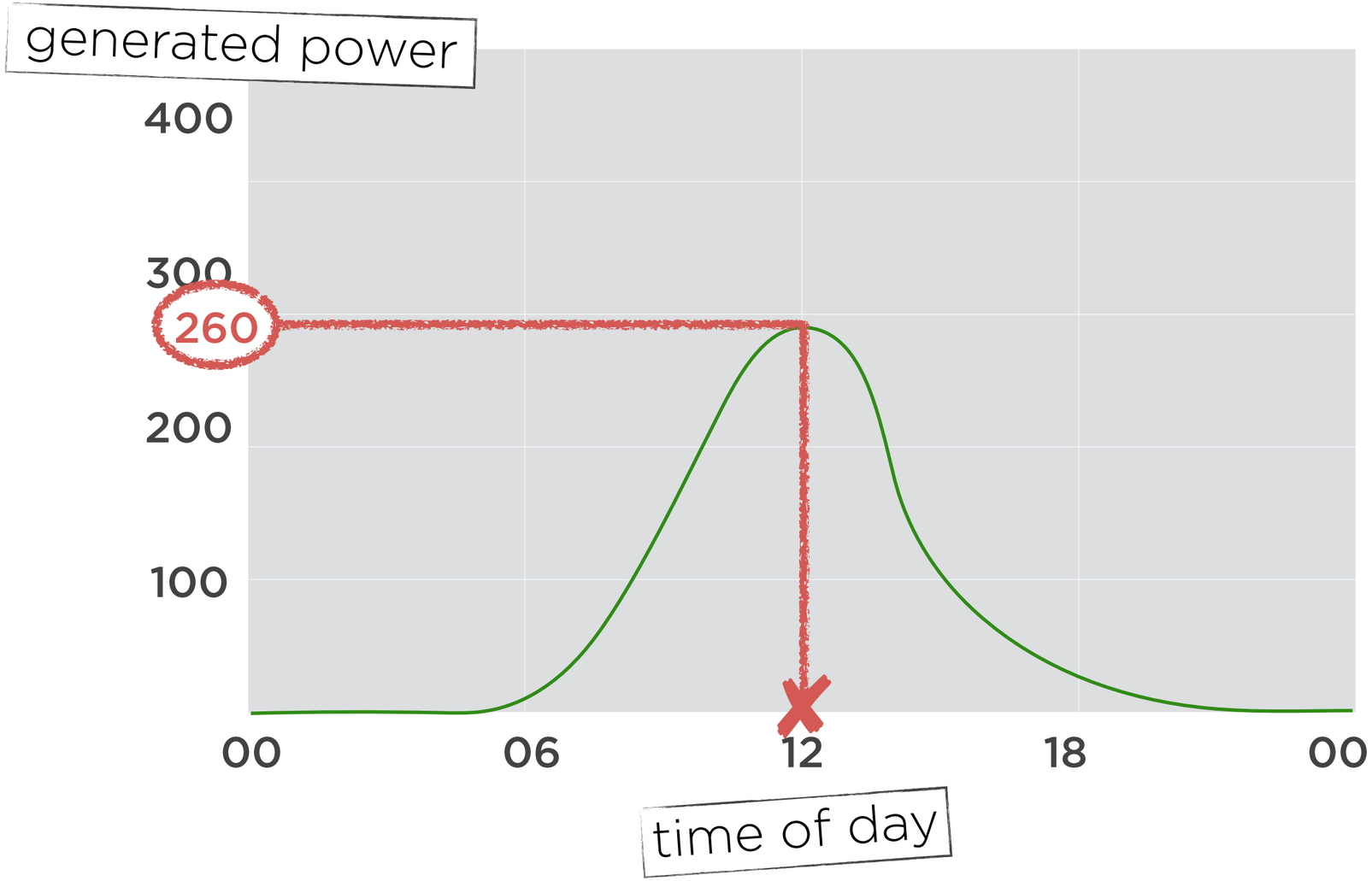
How Supervised Learning Works



The Model



The Model



Supervised learning finds a model that approximates the examples.

Summary

Machine learning vs. programming

The two phases of supervised learning

- Training
- Prediction

How supervised learning works