# End-to-end deep learning

deeplearning.ai

## What is end-to-end deep learning

One of the most exciting recent development in deep learning, has been the rise of end-to-end deep learning.
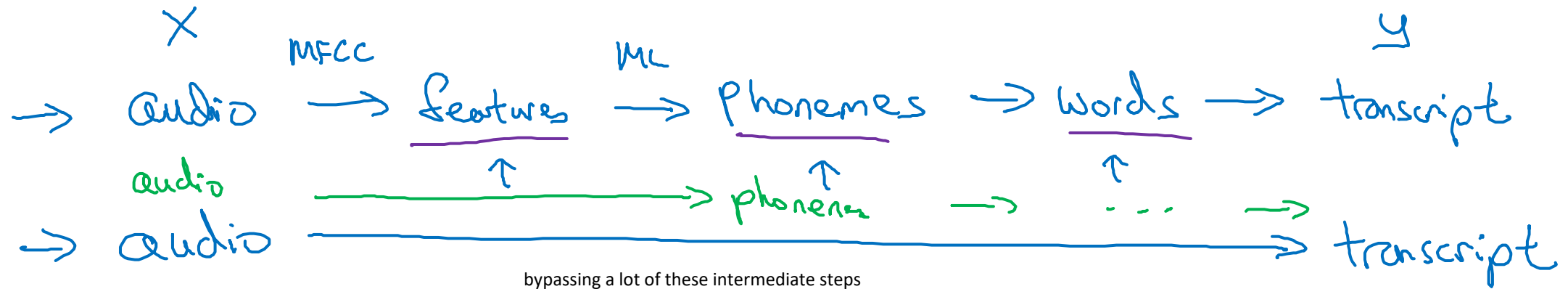
Briefly, there have been some data processing systems, or learning systems that require multiple stages of processing. And what end-to-end deep learning does, is it can take multiple stages and replace it usually with just a single neural network

# What is end-to-end learning?

## Speech recognition example

"cat"

$X$

An algorithm for extracting a certain set
of hand designed features for audio

$y$

$\rightarrow$ audio $\xrightarrow{MFCC}$ features $\xrightarrow{ML}$ Phonemes $\rightarrow$ Words $\rightarrow$ transcript

audio

$\rightarrow$ audio $\longrightarrow$ phonemes $\longrightarrow$ $\cdots$ $\longrightarrow$ transcript
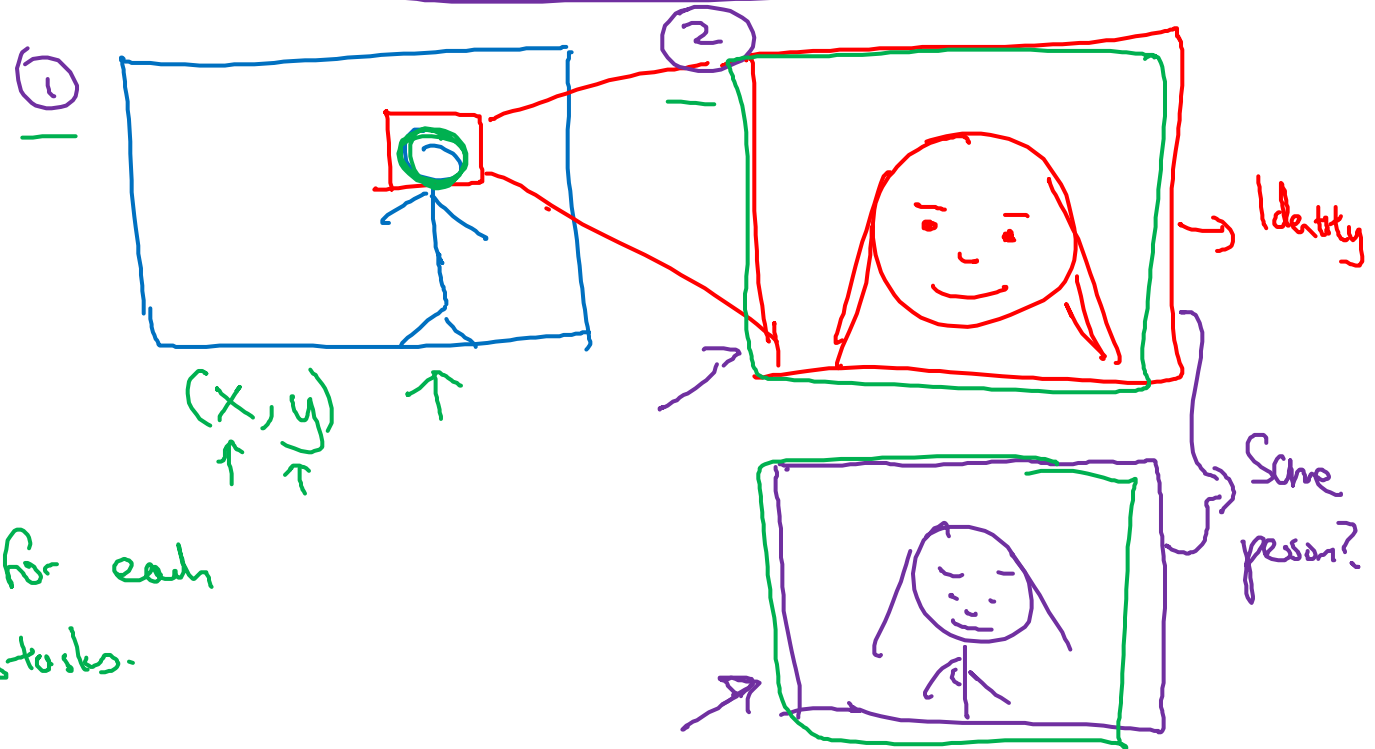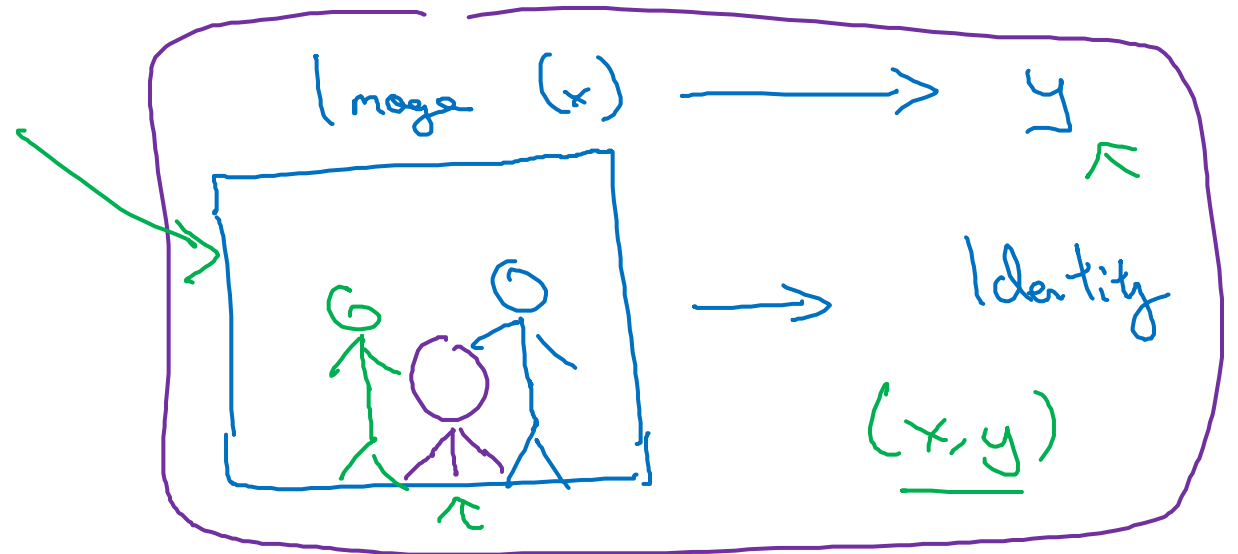
bypassing a lot of these intermediate steps

3,000h

10,000h
⋮
100,000h

It turns out that one of the challenges of end-to-end deep learning is that you might need a lot of data before it works well.
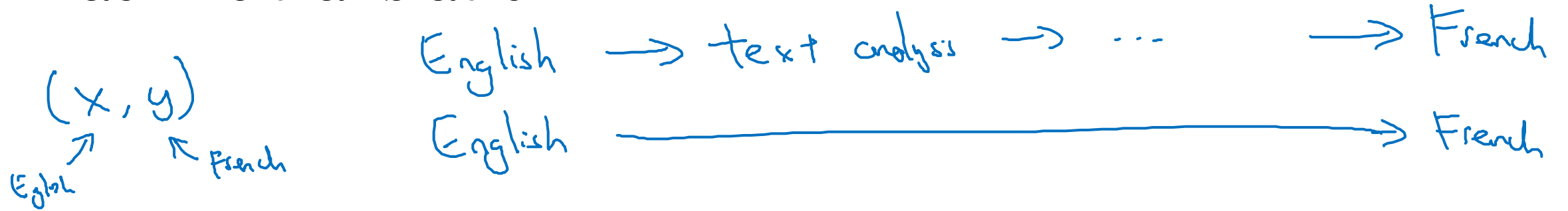
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# Face recognition



[Image courtesy of Baidu]

Image (x) → y

Identity

(x, y)

① (x, y)

② Identity

Same person?

Have data for each of 2 subtasks.

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# More examples

## Machine translation

$(x, y)$

English ↗  ↖ French

English → text analysis → ... → French

English ——————→ French

## Estimating child's age:



Image ①→ bones ②→ age

Image ——————→ age ←

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