# Early Examples for Deep Learning

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Deep Learning for Speech

The first breakthrough results of deep learning on large datasets happened in speech recognition

Context-dependent Pre-trained Deep Neural Networks for Large Vocabulary Speech Recognition (Dahl et al 2010)

Diagram RS

Phonemes/Words

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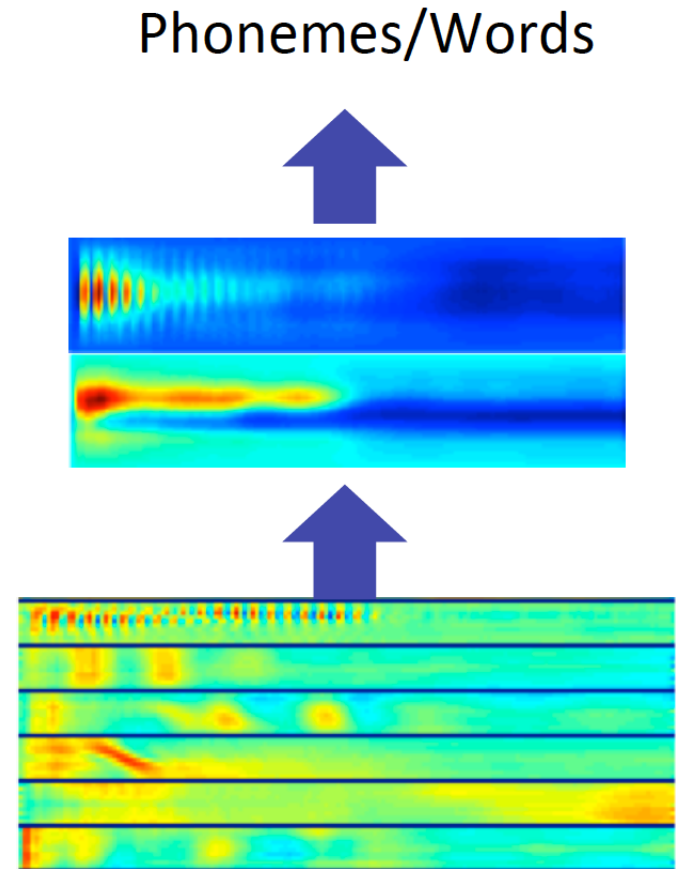
DL Speech Results

Compare state-of-the-art algorithm (GMM 40 mix BMMI) on 309 hours of Switchboard corpus with Deep Belief Network Deep NN with 7 layers by 2048

Shows comparable reduction in error rates as the standard algorithm trained on 2000 hours of sound

Results are error rates

MSR MAVIS Speech System

[Dahl et al. 2012; Seide et al. 2011; following Mohamed et al. 2011]

"The algorithms represent the first time a company has released a deep-neural-networks (DNN)-based speech-recognition algorithm in a commercial product."

Acoustic model & training	Recog \ WER	RT03S FSH	Hub5 SWB
GMM 40-mix, BMMI, SWB 309h	1-pass –adapt	**27.4**	**23.6**
DBN-DNN 7 layer x 2048, SWB 309h	1-pass –adapt	**18.5** (–33%)	**16.1** (–32%)
GMM 72-mix, BMMI, FSH 2000h	*k*-pass +adapt	**18.6**	**17.1**

Diagram MS

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Deep Learning for Vision

Most of the earliest work in deep learning focused on computer vision

Lee et all (2009) Zeiler and Fergus (2013)

Layer 3

Layer 2

Layer 1
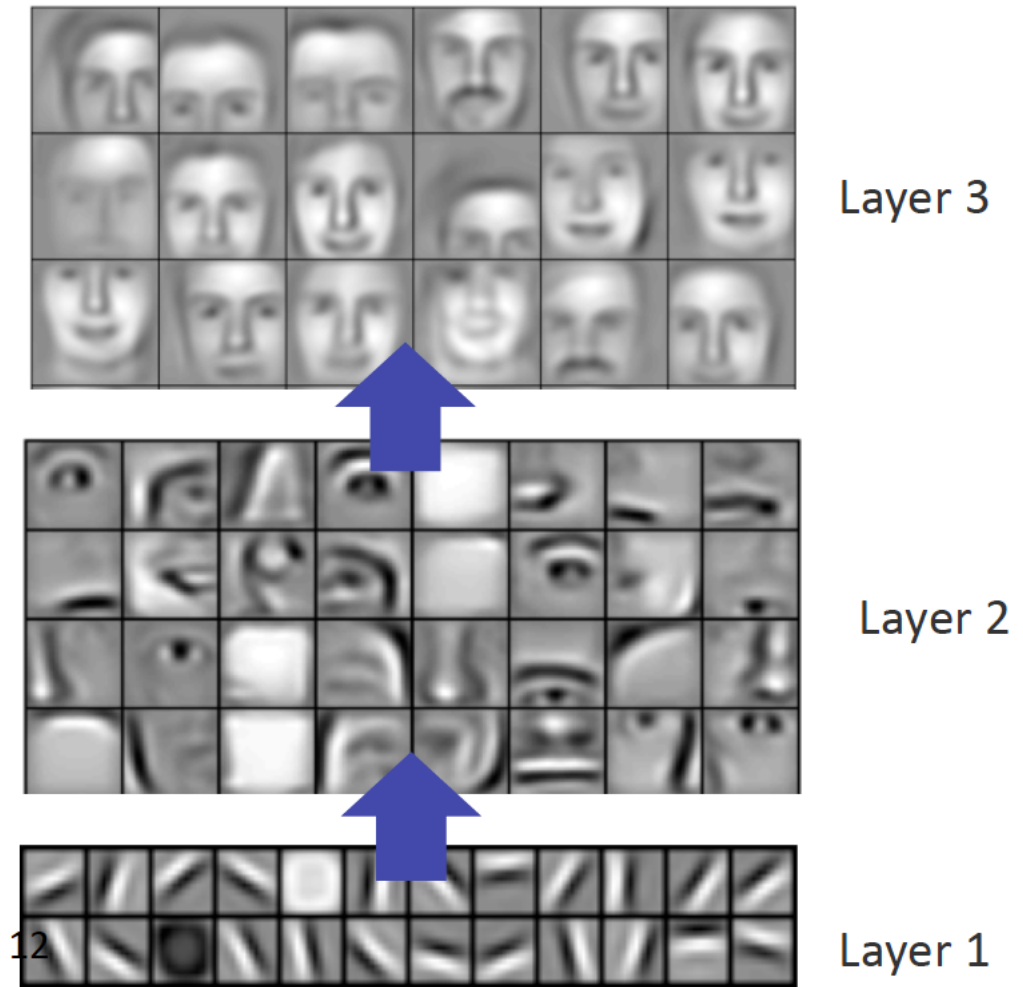
Diagram MS

DL Vision Results

Breakthrough paper: ImageNet Classification with Deep Convolutional Neural Networks by Krizhevsky et al 2012

Model	Top-1	Top-5
Sparse coding [2]	*47.1%*	*28.2%*
SIFT + FVs [24]	*45.7%*	*25.7%*
CNN	**37.5%**	**17.0%**

Table 1: Comparison of results on ILSVRC-2010 test set. In *italics* are best results achieved by others.

Results are error rates

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