Practice of Deep Learning

Raghavendra Singh

Deep learning

Deep Learning = Learning Hierarchical Representations

Y LeCun

Traditional Pattern Recognition: Fixed/Handcrafted Feature Extractor

Feature Extractor → Trainable Classifier

Mainstream Modern Pattern Recognition: Unsupervised mid-level features

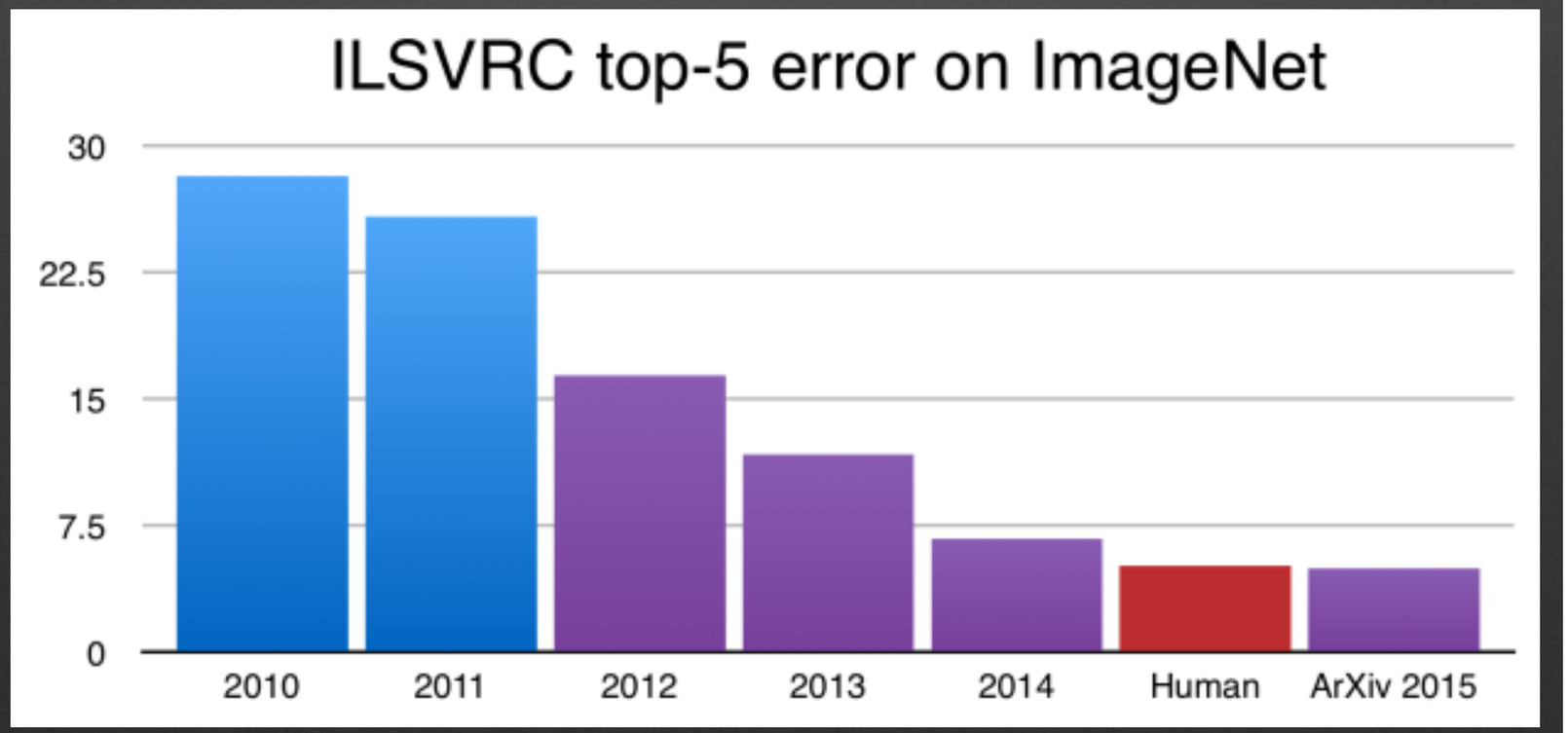
Feature Extractor → Mid-Level Features → Trainable Classifier

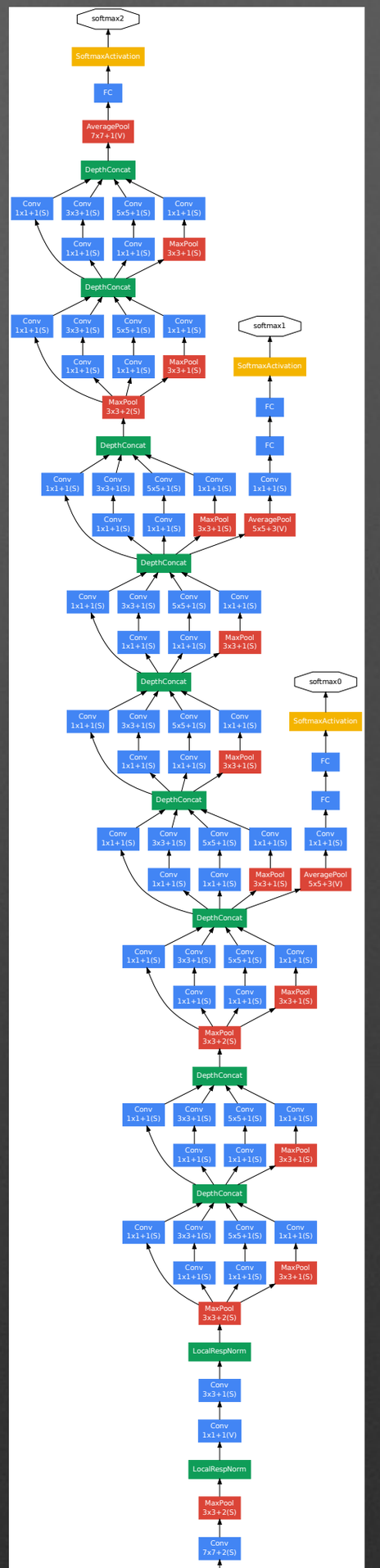
Deep Learning: Representations are hierarchical and trained

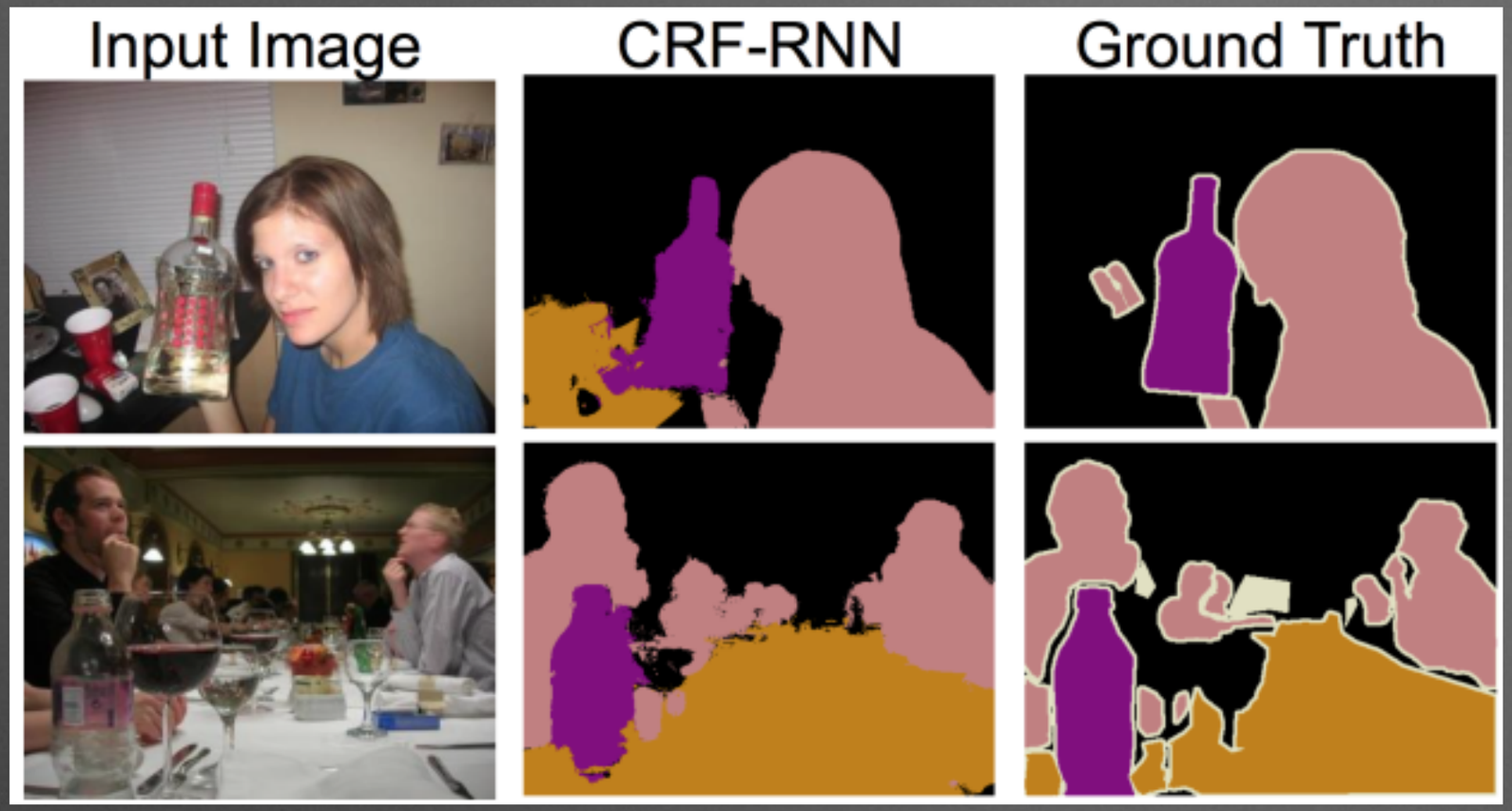
Low-Level Features → Mid-Level Features → High-Level Features → Trainable Classifier

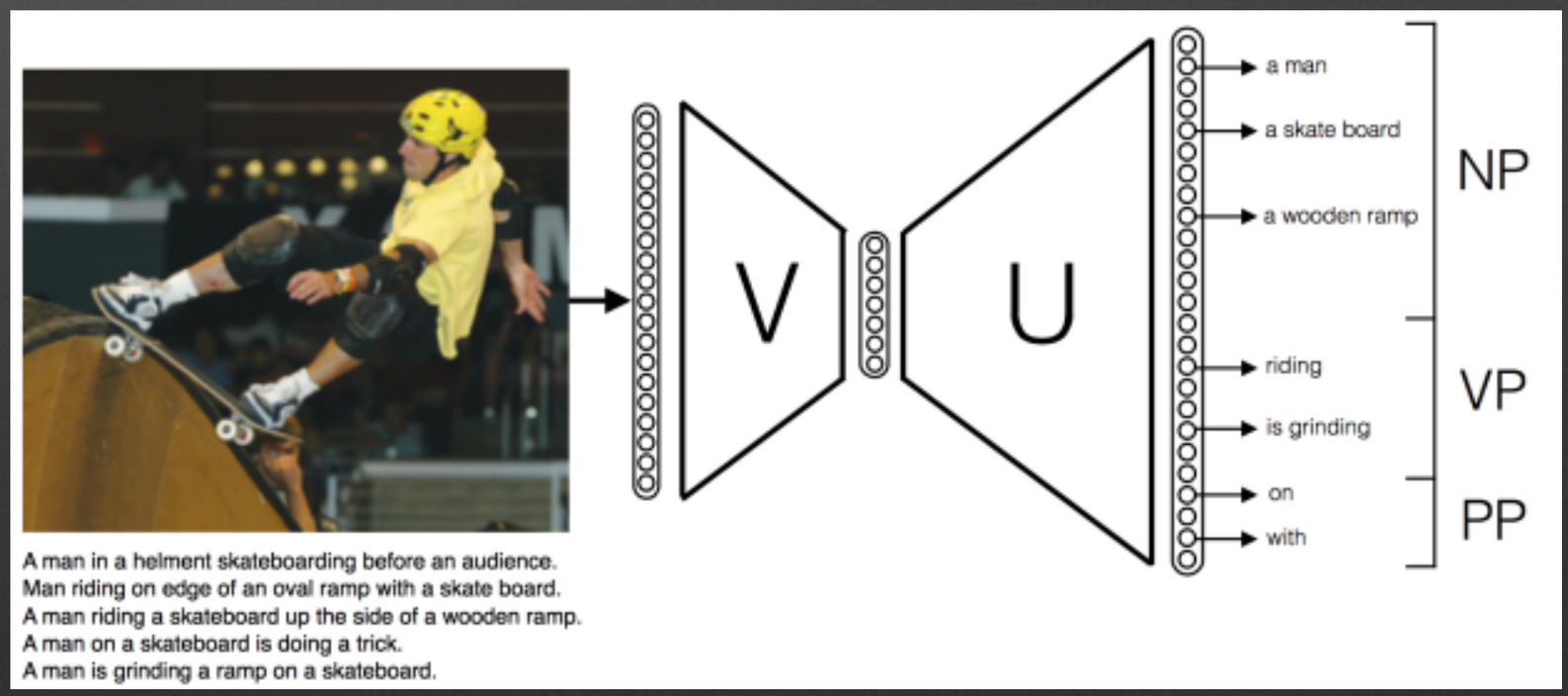
Deep learning is one mechanism for representation learning, which solves the problem of representation learning by introducing representations that are expressed in terms of other simple representations.

ImageNet Large Scale Visual Recognition Challenge, the introduction of deep learning algorithms into the challenge reduced the top-5 error by 10% in 2012. Every year since then, deep learning models have dominated the challenges, significantly reducing the top-5 error rate every year (see Figure 1). In 2015, researchers have trained very deep networks (for example, the Google “inception” model has 27 layers) that surpass human performance.






Input Image
CRF-RNN
Ground Truth


A man in a helment skateboarding before an audience.
Man riding on edge of an oval ramp with a skate board.
A man riding a skateboard up the side of a wooden ramp.
A man on a skateboard is doing a trick.
A man is grinding a ramp on a skateboard.
V
U
a man
a skate board
a wooden ramp
riding
is grinding
on
with
NP
VP
PP

FRANCE	JESUS	XBOX	REDDISH	SCRATCHED	MEGABITS
AUSTRIA	GOD	AMIGA	GREENISH	NAILED	OCTETS
BELGIUM	SATI	PLAYSTATION	BLUISH	SMASHED	MB/S
GERMANY	CHRIST	MSX	PINKISH	PUNCHED	BIT/S
ITALY	SATAN	IPOD	PURPLISH	POPPED	BAUD
GREECE	KALI	SEGA	BROWNISH	CRIMPED	CARATS
SWEDEN	INDRA	PSNUMBER	GREYISH	SCRAPED	KBIT/S
NORWAY	VISHNU	HD	GRAYISH	SCREWED	MEGAHERTZ
EUROPE	ANANDA	DREAMCAST	WHITISH	SECTIONED	MEGAPIXELS
HUNGARY	PARVATI	GEFORCE	SILVERY	SLASHED	GBIT/S
SWITZERLAND	GRACE	CAPCOM	YELLOWISH	RIPPED	AMPERES

What words have embeddings closest to a given word?

Relationship	Example 1	Example 2	Example 3
France - Paris	Italy: Rome	Japan: Tokyo	Florida: Tallahassee
big - bigger	small: larger	cold: colder	quick: quicker
Miami - Florida	Baltimore: Maryland	Dallas: Texas	Kona: Hawaii
Einstein - scientist	Messi: midfielder	Mozart: violinist	Picasso: painter
Sarkozy - France	Berlusconi: Italy	Merkel: Germany	Koizumi: Japan
copper - Cu	zinc: Zn	gold: Au	uranium: plutonium
Berlusconi - Silvio	Sarkozy: Nicolas	Putin: Medvedev	Obama: Barack
Microsoft - Windows	Google: Android	IBM: Linux	Apple: iPhone
Microsoft - Ballmer	Google: Yahoo	IBM: McNealy	Apple: Jobs
Japan - sushi	Germany: bratwurst	France: tapas	USA: pizza

Relationship pairs in a word embedding

Schedule and Marks

WEEK	SESSION	NOTES
1	Alpha Go	
2	Guest Lecture (2 parts)	
3	Feed forward NN AutoEncoders	Data and System Setup
4	Caffe Theano	Assignment 1 50% Caffe on Images 50% Theano on NLP
5	Quiz Reverse Class I	Quiz 5%
6	Optimization Review	
7	Demos	Assignment 1 10%
8	Recurrent NN	Assignment 2 50% Images 50% NLP (switch)
9	Reverse Class II	
10	Mallat Scattering Wavelet and associated theory	
11	Demos	Assignment 2 10%
12	Devil in the details	Final Projects
12	Reverse Class III	
13	Project Presentation	Projects 50%
14	Finals	Finals 25%

Notes

- Class participation
- Forum participation (Piazza)
- Individual assignments
- Projects can be upto 2 people
    - Vanilla version 25% (something people have done before) — binary works or does not
    - Topping version 10%
    - Presentation 15%
- No large data set; mostly fine tuning large models;
- Completion is must
- Honest copying and citing related work is allowed
    - But submitted material will be checked for violations