

Deep Learning for Estimation of Human Semantic Traits

data & knowledge

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Introduction



How would you describe an unknown person?

- Man
- 25-35 years old
- Blue eyes
- Dark hair
- Beard
- etc.

Soft Biometrics Traits
physical, behavioral or adhered human characteristics, classifiable in predefined human compliant categories

Localization-Dependent Traits
 (localized in a particular part of the face: color of eyes, form of the nose, color of hair, presence of beard, presence of rids, etc.)

Human Semantic Traits
 (do not have a particular localization in the face: gender, age, etc.)

Motivations & Challenges



Insignificant contrast changes can change gender perception: woman on the left and man on the right (while pictures are identical)

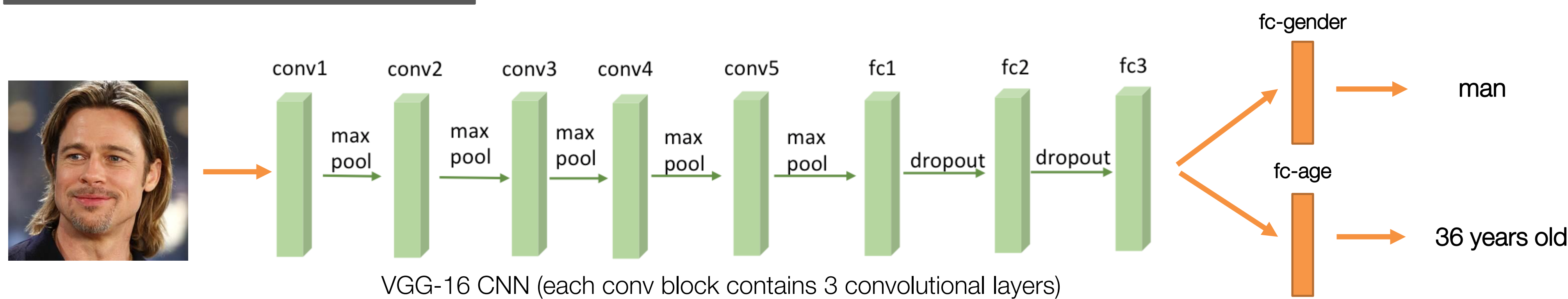


Wrinkles, hair color, face proportions CANNOT be precise indicators of age in general case

Possible use cases for Orange:

- Personalized services
- Intelligent cloud storage
- Demographics collection

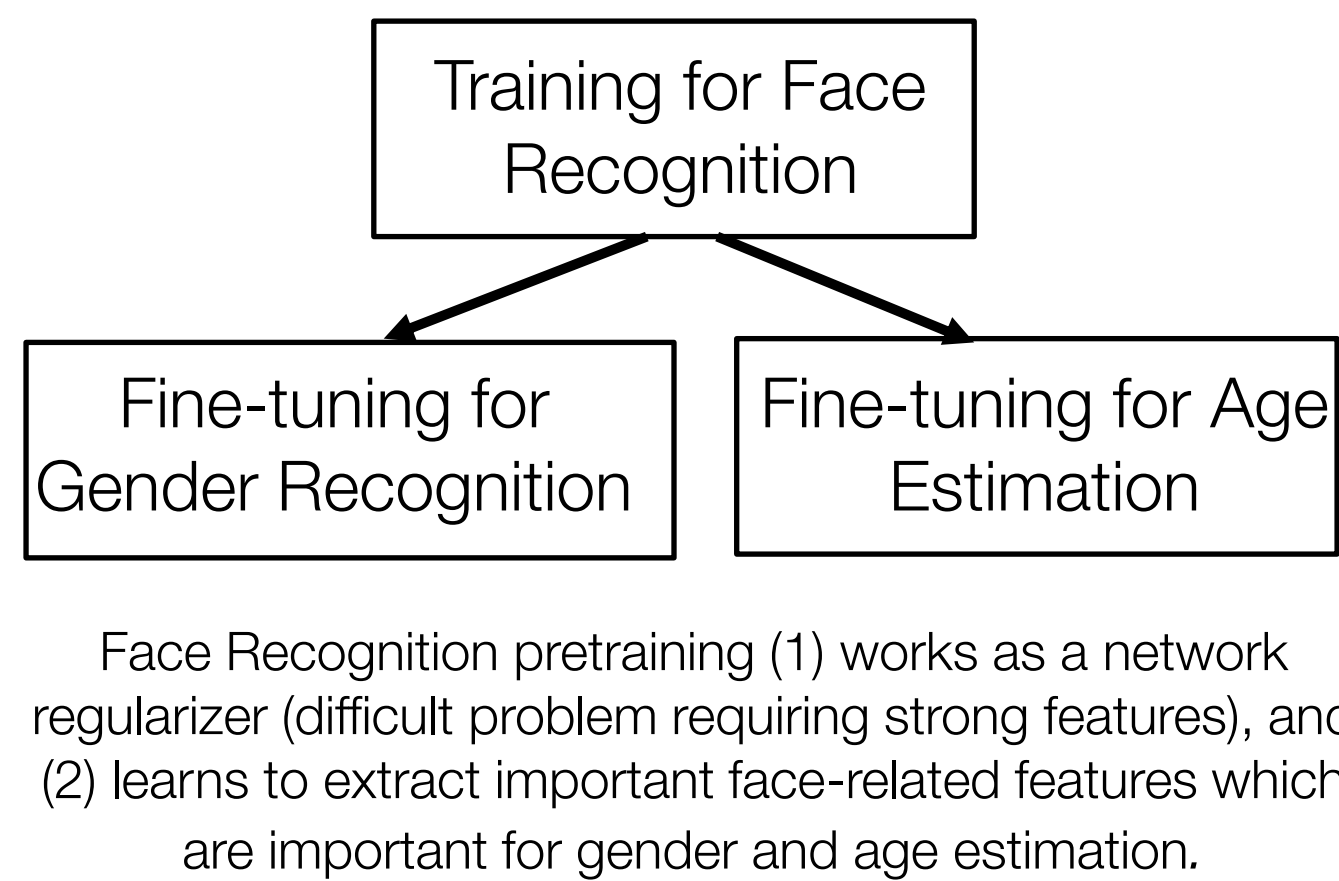
Solution



3 key issues to be defined:

- Training strategy
- Loss function to optimize
- Training data

Training Strategy



Age Encoding

$$L_i = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(i-x)^2}{2\sigma^2}}$$

L is age labels vector
 Real age: 30 years old

Contrary to pure classification encoding, label distribution encoding enables to maintain the continuous nature of age. By varying the σ value, we can define the level of age estimation error which is tolerated while training

Training Data



Results

Scores on Public Benchmarks

Gender (LFW)

Year	Cross-dataset	Accuracy
2012	No	94.8%
2013	No	98.1%
2013	Yes	95.6%
2015	Yes	96.9%
2015 (Orange)	Yes	97.3%
2016 (Orange)	Yes	98.9%

Age (MORPH)

Year	Cross-dataset	MAE
2011	No	4.18
2014	No	3.92
2014	No	3.63
2015	No	3.49
2016 (Orange)	No	3.05
2016 (Orange)	Yes	4.55



1st Place in International Age Estimation Challenge

Position	Team	ϵ -score
1	OrangeLabs	0.2411
2	palm_seu	0.3214
3	cmp+ETH	0.3361
4	WYU_CVL	0.3405
5	ITU_SiMIT	0.3668
6	Bogazici	0.3740
7	MIPAL_SNU	0.4569
8	DeepAge	0.4573

Scores on a very challenging internal benchmark: gender: 97.1% (99.0%/95.2%); age: 4.27 of MAE