Big Data and Deep Learning

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STRENGTHENING THE BIG DATA & ANALYTICS ECOSYSTEM

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Machine Surpasses Human-level Image Classification
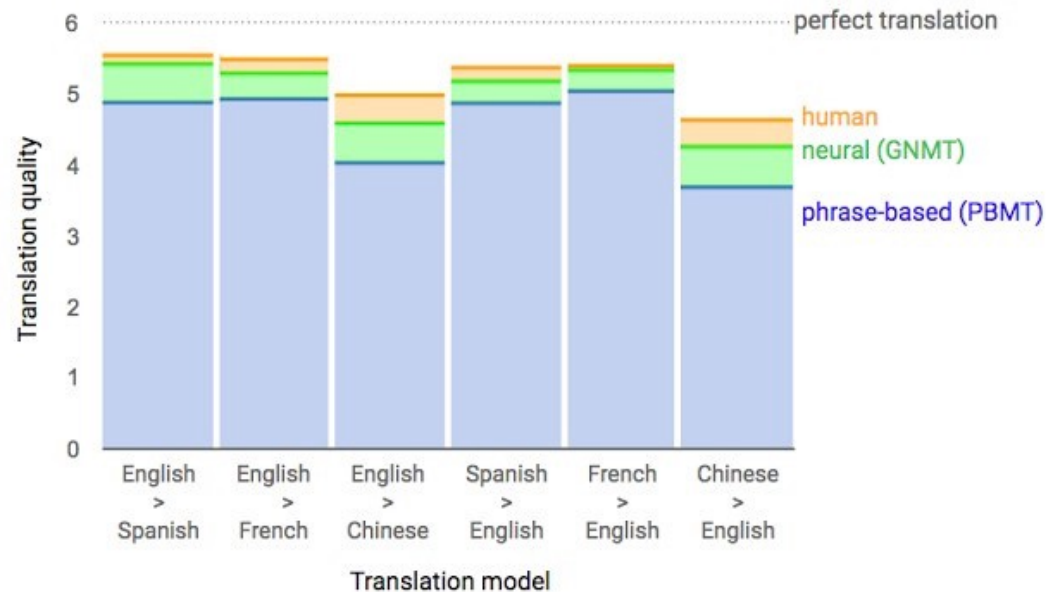
Machine surpasses Human-level Image Classification
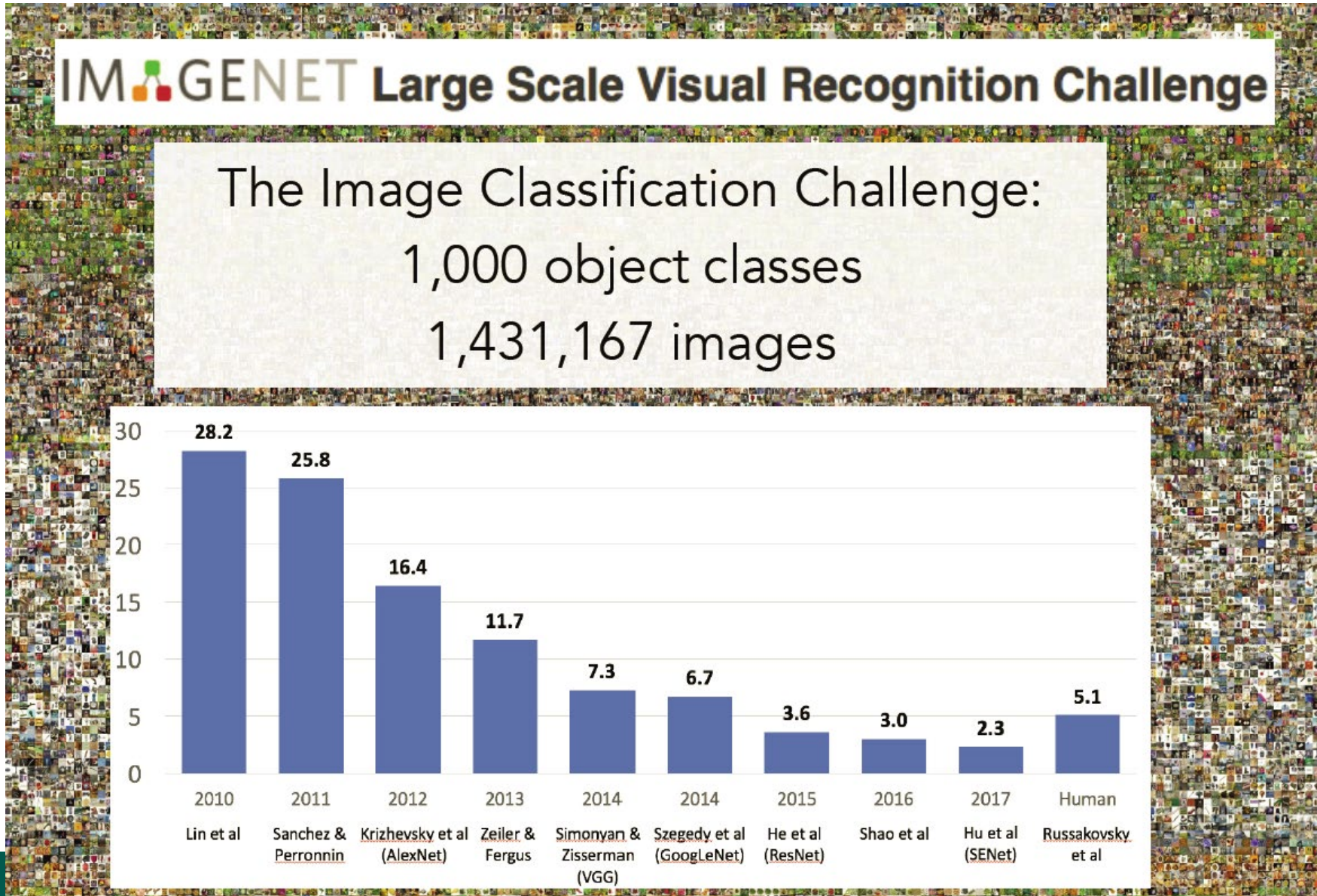
Closing Down the Gap of Machine Translation

- **Google Neural Machine Translation**
    - Recently, Google announced the launch of a new model for Google Translate with deep learning architecture - Recurrent Neural Network (RNN).
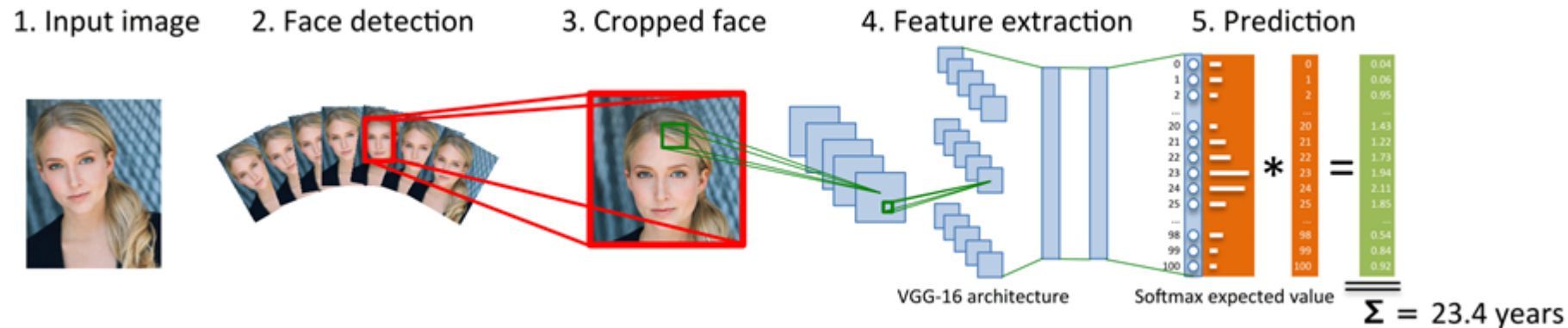

    - The key outcome: closing down the gap with humans in accuracy of the translation by 55–85%. It is difficult to reproduce good results with this model without the huge dataset that Google has.

Ford URP: Ranking-CNN for Driver Age Estimation – CVPR 17, 18

- Pose, Illumination, Occlusion, Motion, etc.
- Deep and Transfer Learning Model trained with 500k+ Face images from IMDB, Wikipedia, and MORPH II with age and gender labels

1. Input image   2. Face detection   3. Cropped face   4. Feature extraction   5. Prediction

VGG-16 architecture   Softmax expected value   Σ = 23.4 years
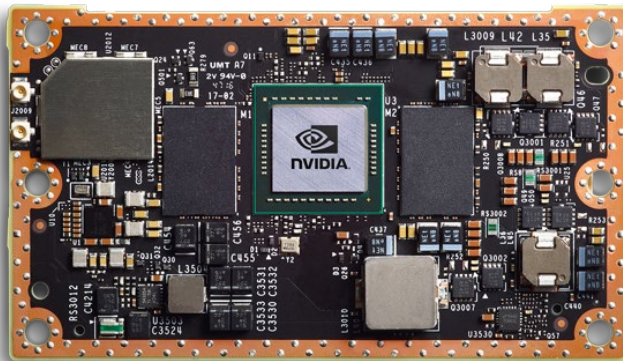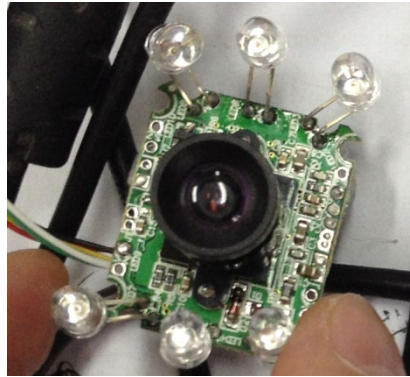
IMDb

460,723 images

Wikipedia

62,328 images

Ford URP: Ranking-CNN for Driver Age Estimation

day/night capability,
delivering vibrant color images
during the day and high resolution
b/w images at night.
More robust to illumination changes

Onboard video processing
Nvidia GPU-based Architecture
Input/output Design

Presurgical Evaluation for Epilepsy: Brain Fiber Classification

- Many kids take epilepsy surgery every year: evaluate the risk of damaging functionally important white matter fibers
- Innovation: Diffusion Tensor Imaging(DTI)+Deep Learning to replace current gold standard: Electrical Stimulation Mapping which involves opening skull and placing sensors.
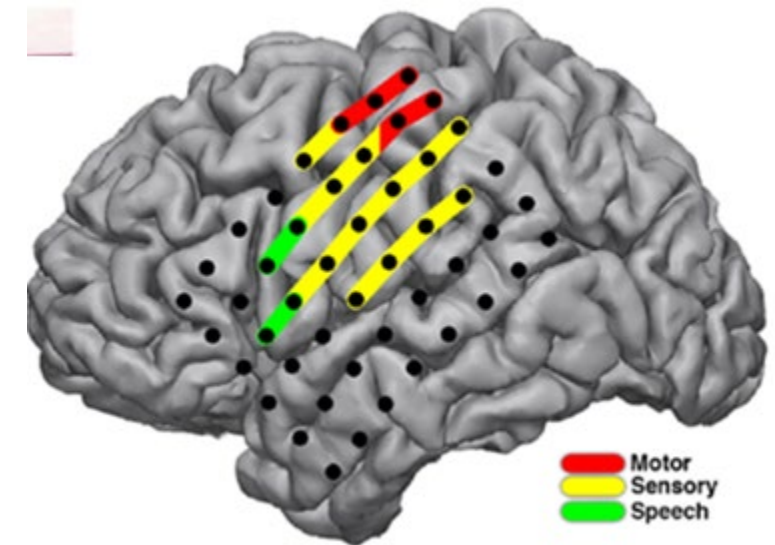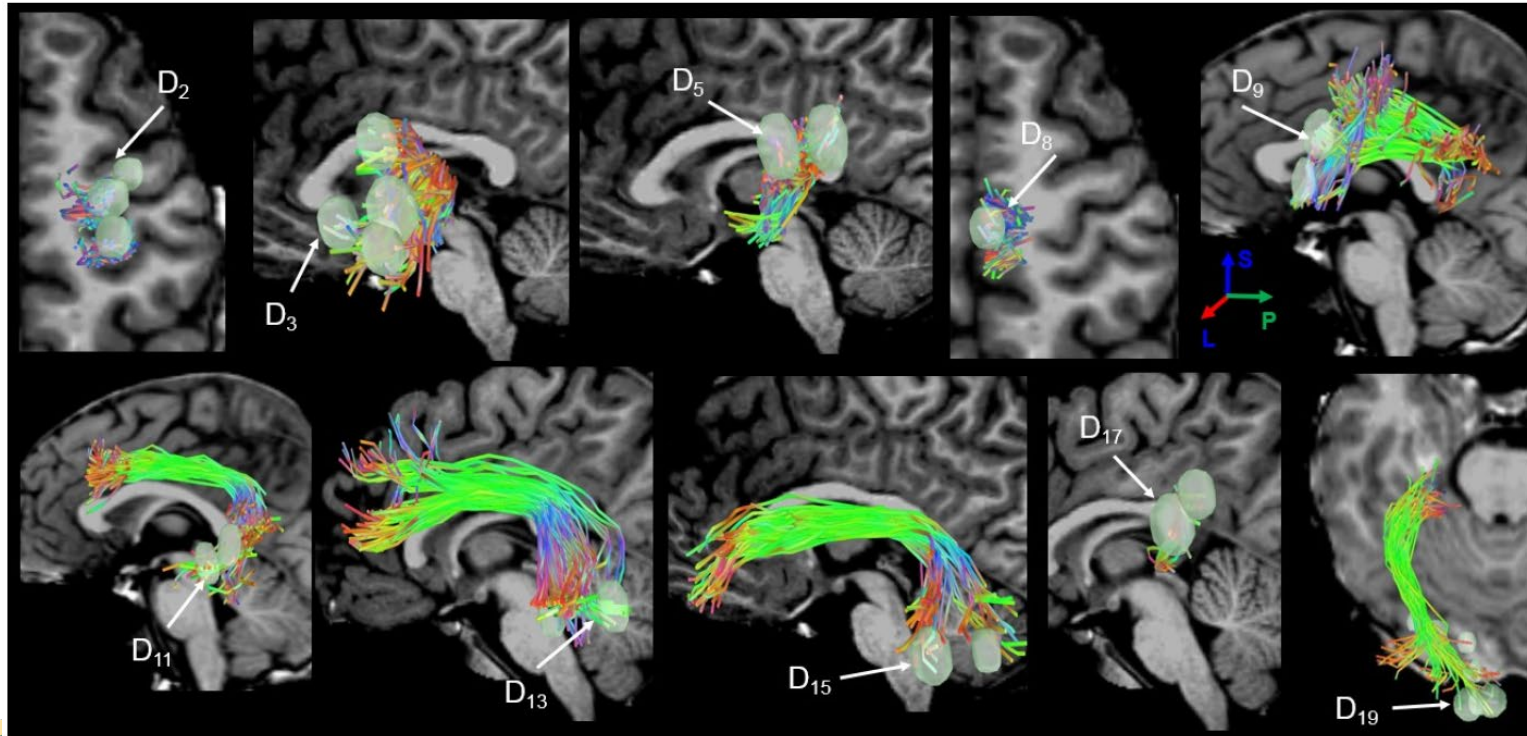
ESM, Roland et al., Front. Hum. Neurosci. 2013

Brain Fiber Tracking and Classification

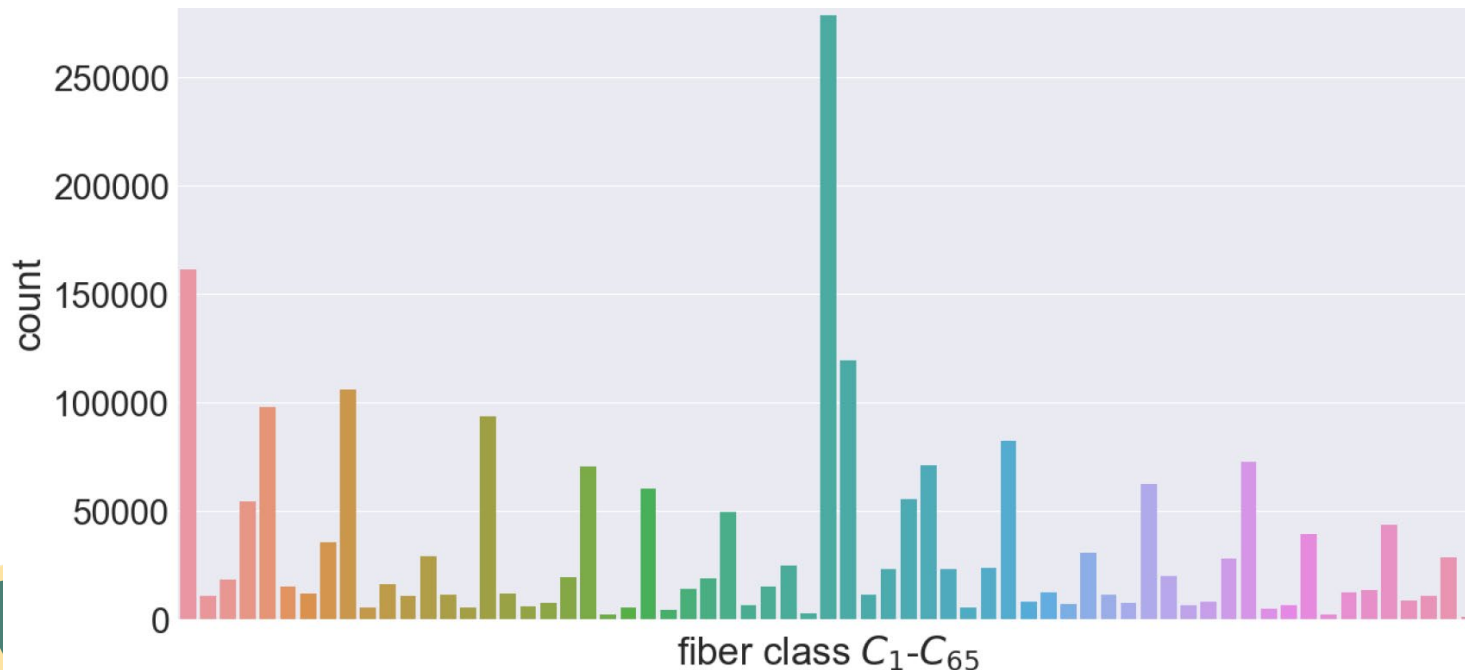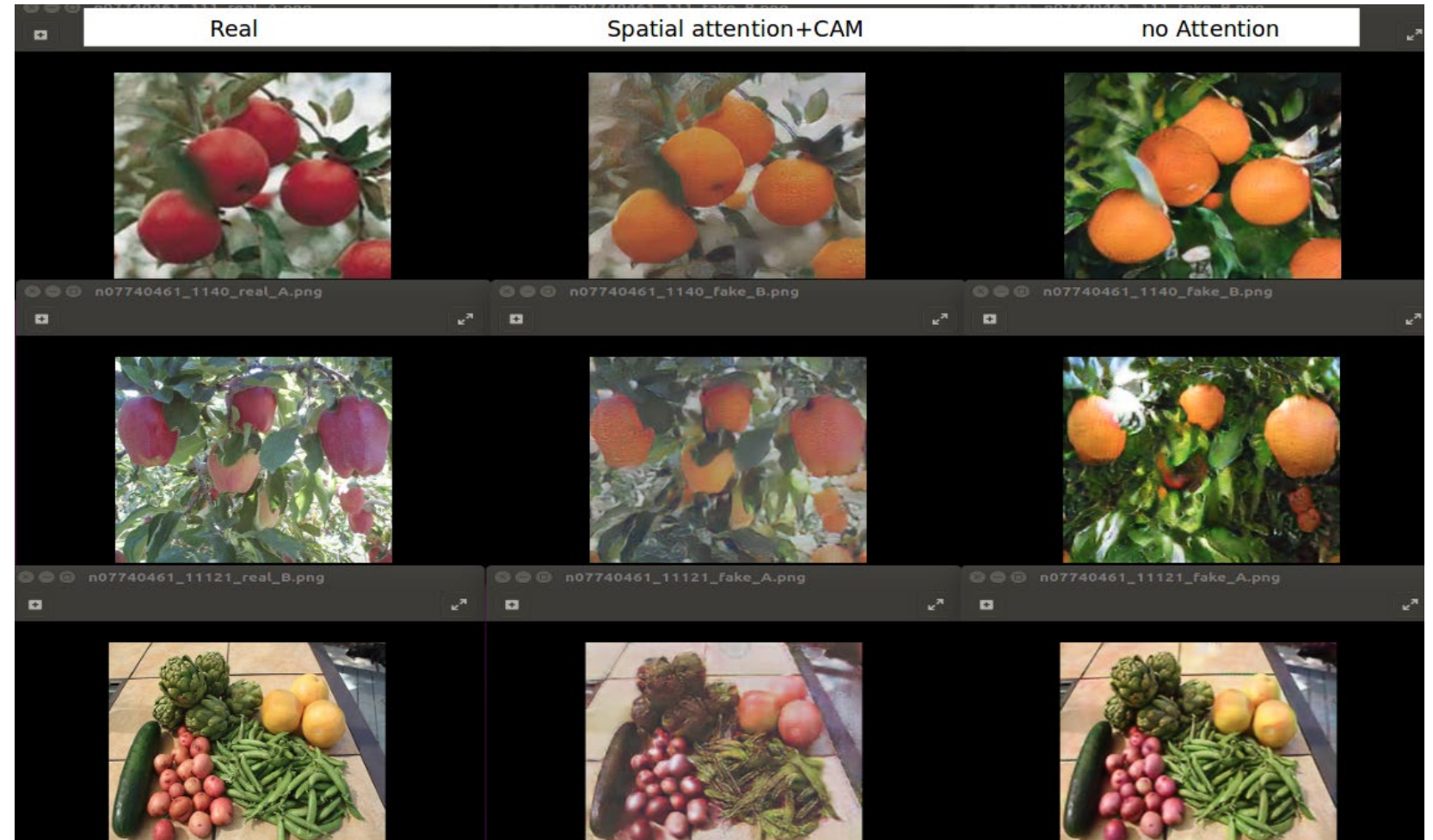- With Prof. Jeong in the Department of Pediatrics on an NIH project
- 65 categories of fibers collected by DTI, 5.5M in total
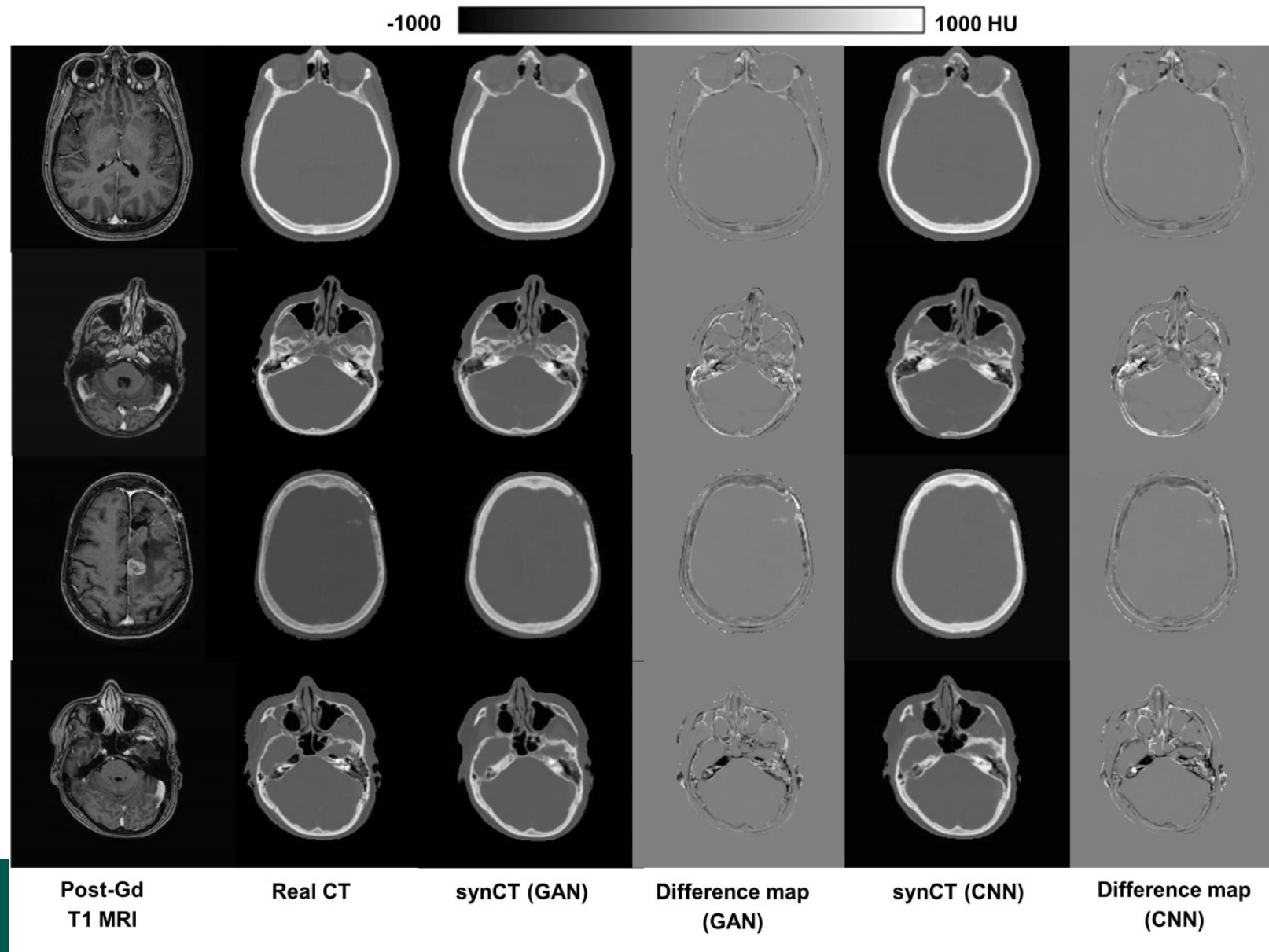- Deep Learning Model for Heavily Unbalanced Data

Function	Fiber Class Index	From	To
somatosensory	$C_{1,34}$	arm area	PLIC
	$C_{4,37}$	face area	PLIC
	$C_{5,38}$	finger area	PLIC
	$C_{16,49}$	leg area	PLIC
language	$C_{7,40}$	ifop	itg
	$C_{8,41}$	ifop	mtg
	$C_{9,42}$	ifop	sma
	$C_{10,43}$	ifop	spm
	$C_{11,44}$	ifop	stg
	$C_{12,45}$	iftr	itg
	$C_{13,46}$	iftr	mtg
	$C_{14,47}$	iftr	stg
	$C_{18,51}$	mdfg	ang
	$C_{19,52}$	mdfg	itg
	$C_{20,53}$	mdfg	mtg
	$C_{21,54}$	mdfg	sma
	$C_{22,55}$	mdfg	spm
	$C_{23,56}$	mdfg	stg
	$C_{26,59}$	prec	ang
	$C_{27,60}$	prec	itg
	$C_{28,61}$	prec	mtg
	$C_{29,62}$	prec	spm
	$C_{30,63}$	prec	stg
auditory	$C_{25,58}$	mtg	icg
	$C_{32,65}$	stg	icg
visual	$C_{2,35}$	calc	lgn
	$C_{3,36}$	cune	lgn
	$C_{6,39}$	fusi	lgn
	$C_{15,48}$	iocc	lgn
	$C_{17,50}$	ling	lgn
	$C_{24,57}$	mocc	lgn
	$C_{31,64}$	socc	lgn
other	C_{33}	-	-

Image to Image Translation

Henry Ford Health System: Synthetic CTs

-1000   1000 HU

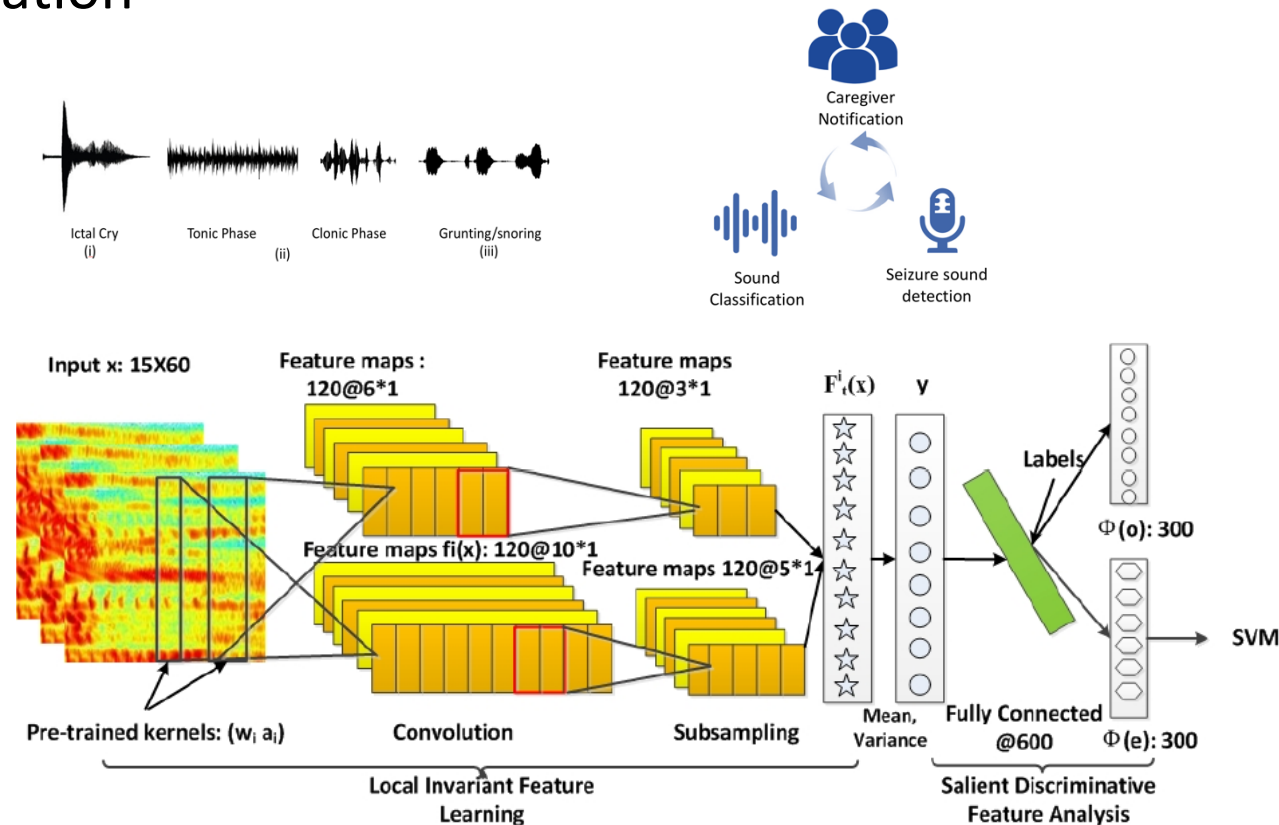| Post-Gd T1 MRI | Real CT | synCT (GAN) | Difference map (GAN) | synCT (CNN) | Difference map (CNN) |

The Sound of Seizures

- With Prof. Basha in the Department of Neurology
- The sound of seizures: Deep learning model for acoustic event detection
- Epilepsy Foundation

Predicting the Outcome of Patient-Provider Communication Sequences

- With Prof. Carcone in the Department of Family Medicine and Public Health Sciences and Prof. Kotov in Department of Computer Science.
- Deep Neural Model for Natural Language Understanding
- Federal supports

Table 1: Fragment of the annotated transcript of a dialogue between a counselor and an adolescent. MYSCOPE codes assigned to the utterances and their meaning are shown in the first two columns.

Code	Behavior	Speaker	Utterance
SS	Structure Session	Counselor	Okay. Can I meet with Xxxx alone for a few minutes?
OQO	Open-ended question, other	Counselor	So, Xxxx, how you doing?
HUPO	High uptake, other	Adolescent	Fine
OQTBN	Open-ended question, target behavior neutral	Counselor	That's good. So, tell me how do you feel about your weight?
CHT+	Change talk positive	Adolescent	It's not the best.
CQECHT+	Closed question, elicit change talk positive	Counselor	It's not the best?
CHT+	Change talk positive	Adolescent	Yeah
CQTBN	Closed question, target behavior neutral	Counselor	Okay, so have you tried to lose weight before?
HUPW	High uptake, weight	Adolescent	Yes

DIG TOGETHER