Big Data and Deep Learning

Prof. Ming Dong
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Department of Computer Science
Machine Surpasses Human-level Image Classification

The Image Classification Challenge:
1,000 object classes
1,431,167 images

Output:
- Scale
- T-shirt
- Steel drum
- Drumstick
- Mud turtle

Output:
- Scale
- T-shirt
- Giant panda
- Drumstick
- Mud turtle

IMAGENET Large Scale Visual Recognition Challenge
Machine surpasses Human-level Image Classification

The Image Classification Challenge:
1,000 object classes
1,431,167 images
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

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

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
Image to Image Translation

Input
Ground truth
Output

Real
Spatial attention + CAM
no Attention

[Images of different objects in various states: input, ground truth, output, and the results with different attention mechanisms.]
Henry Ford Health System: Synthetic CTs
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>
<thead>
<tr>
<th>Code</th>
<th>Behavior</th>
<th>Speaker</th>
<th>Utterance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>Structure Session</td>
<td>Counselor</td>
<td>Okay. Can I meet with Xxxx alone for a few minutes?</td>
</tr>
<tr>
<td>OQO</td>
<td>Open-ended question, other</td>
<td>Counselor</td>
<td>So, Xxxx, how you doing?</td>
</tr>
<tr>
<td>HUPO</td>
<td>High uptake, other</td>
<td>Adolescent</td>
<td>Fine</td>
</tr>
<tr>
<td>OQTBN</td>
<td>Open-ended question, target behavior neutral</td>
<td>Counselor</td>
<td>That’s good. So, tell me how do you feel about your weight?</td>
</tr>
<tr>
<td>CHT+</td>
<td>Change talk positive</td>
<td>Adolescent</td>
<td>It’s not the best.</td>
</tr>
<tr>
<td>CQECHT+</td>
<td>Closed question, elicit change talk positive</td>
<td>Counselor</td>
<td>It’s not the best?</td>
</tr>
<tr>
<td>CHT+</td>
<td>Change talk positive</td>
<td>Adolescent</td>
<td>Yeah</td>
</tr>
<tr>
<td>CQTBN</td>
<td>Closed question, target behavior neutral</td>
<td>Counselor</td>
<td>Okay, so have you tried to lose weight before?</td>
</tr>
<tr>
<td>HUPW</td>
<td>High uptake, weight</td>
<td>Adolescent</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Smart Meter
‘Big Data’
Gold Mine

DIG TOGETHER