- Title
  - Age estimation using deep convolutional neural network

- Team details
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  - Team website URL
    - None
  - Affiliation
    - None

- Contribution details
  - Title of the contribution
    - Age estimation using deep convolutional neural network
  - Final score
    - Unknown at the time of writing
  - General method description
    - Deep convolutional neural network (CNN) is used for age estimation

- We used Caffe library for experimentation.
- I assumed this task as regression problem
- 1. Initial Finetuning
  - We started training(finetuning) using GoogLeNet which is pretrained on ImageNet database.
  - We utilized following publically available dataset for training
    - Cross-age Celebrity Dataset (CACD)
    - The image of Groups Dataset
    - Adience collection of unfiltered faces
  - We also utilized following publically available dataset for semi-supervised learning (using pseudolabel) while training
    - Faces in the Wild
    - Labeled Faces in the Wild
  - We partitioned dataset into 10-fold, so 9 fold is used as training set and remaining 1 fold is used as validation set. Theoretically, we can train 10 models by switching validation set fold. But due to the shortage of computing resource and time, we trained only 3 models.
- 2. Finetuning
  - Initially trained model from above step 1 is finetuned
  - Training set from Codalab is used as training set for finetuning.
  - Validation set from Codalab is used as validation set for finetuning
- 3. Combining scores from trained models
  - Output scores (predicted age) from 3 trained models are averaged to produce output

- References
  - Caffe : http://caffe.berkeleyvision.org/
  - CACD : http://bcsiriuschen.github.io/CARC/

- The image of Groups Dataset : http://chenlab.ece.cornell.edu/people/Andy/ImagesOfGroups.html
- Adience collection of unfiltered faces : http://www.openu.ac.il/home/hassner/Adience/data.html
- Faces in the Wild : http://tamaraberg.com/faceDataset/index.html
- Labeled Faces in the Wild : http://vis-www.cs.umass.edu/lfw

- Describe data preprocessing techniques applied (if any)
  - For training data augmentation in deep learning model training, each image is randomly resized to 224 ~ 268 pixel (per each side), random mirroring (left-right flipping of image) is applied, then 224 pixel (per each side) image window is randomly cropped.

- Face Detection Stage
  - No face detection or face landmark based method is used.

- Global Method Description
  - Total method complexity
    - It took me roughly 2 days (using GPU) to train 1 deep CNN model
  - Which pre-trained or external methods have been used (for any stage, if any)
    - We started from GoogLeNet which is pretrained on ImageNet database
  - Which additional data has been used in addition to the provided ChaLearn training and validation data (at any stage, if any)
    - As mentioned above, we used publically available dataset listed below for training deep CNN in initial finetuning stage.
      - Cross-age Celebrity Dataset (CACD)
      - The image of Groups Dataset
      - Adience collection of unfiltered faces
      - Faces in the Wild

        - Labeled Faces in the Wild
    - Qualitative advantages of the proposed solution
        - We didn't used any hand-crafted imaging features or face landmark detection method for training. Only deep convolutional neural network is used for training. So our experimental method has large flexibility and applicability.
        - We tried to use semi-supervised method to utilize unlabeled dataset for training.
    - Results of the comparison to other approaches (if any)
        - Evaluation results are not available at the time of writing
    - Novelty degree of the solution and if is has been previously published
        - I published experiments using finetuning from GoogLeNet in the following recent papers.
            - Choi, Sungbin. "Plant identification with deep convolutional neural network: Snumedinfo at lifeclef plant identification task 2015." *Working notes of CLEF 2015 conference*. 2015.
            - Choi, Sungbin. "Fish identification in underwater video with deep convolutional neural network: SNUMedinfo at LifeCLEF fish task 2015."

- Other details
    - Language and implementation details (including platform, memory, parallelization requirements)
        - C++, Caffe library with using NVIDIA Titan GPU
    - Human effort required for implementation, training and validation?
        - We implemented experimental code on top of Caffe library.
        - Training and validation step is processed automatically without manual intervention
    - Training/testing expended time?
        - Roughly 1~2 days are spent for training each CNN model.
        - For testing, it took roughly 5 minutes to get scores from one CNN model

- General comments and impressions of the challenge? what do you expect from a new challenge in face and looking at people analysis?
  - I enjoyed participating this challenge. I think predicting human emotion or interpreting body language is also interesting for next challenge topic.