4-6 Wednesday – 210-GD3

Special topics in Computer Science INT3121 20

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Slide & Code: https://github.com/chupibk/INT3121-20

Image classification with convolutional neural networks

Week	Content	Class hour	Self-study hour
1 28/8/2019	Introduction Image classification problem and its applications A toy problem with CIFAR10	2	1
2 (4/9/2019)	CNN model architectures and visualization	2	1
3 (11/9/2019)	Training and tuning parameters Automatic parameter learning	2	1
4 (18/9/2019)	Data augmentation Data generator	2	2-6
5 (25/9/2019)	Transfer learning	2	2-6
6 (2/10/2019)	Multi-output image classification	2	2-6
7 (9/10/2019)	Building a training dataset How to write a report	1	2-6
8, 9, 10, 11	Seminar: Bag of tricks with CNN (as mid-term tests)	1	2-6
12, 13, 14	Final project presentations	1-3	2-6
15	Class summarization	1	open

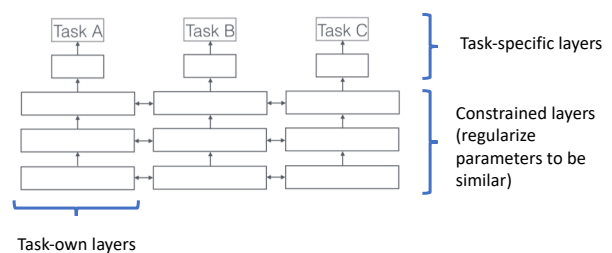# Recall week 6: Multi-output classification (or Multi task learning)

Image credit: pyimagesearch.com

MTL methods

Task-specific layers

Shared layers

Task A Task B Task C

Hard parameter sharing

Task-specific layers

Constrained layers
(regularize
parameters to be
similar)

Task-own layers

Task A   Task B   Task C
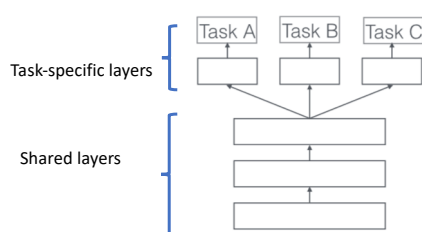
Soft parameter sharing

```
multipliers = {'dense_1': 0.5, 'dense_2': 0.4}
opt = LearningRateMultiplier(SGD, lr_multiplier=multipliers, lr=0.001, momentum=0.9)
```

Image credit: Sebastian Ruder, https://arxiv.org/pdf/1706.05098.pdf

Define a MTL model & training

```
model = Model(
    inputs=inputs,
    outputs=[outBranch1, outBranch2]
)

model.compile(loss={'branch1': 'categorical_crossentropy',
                    'branch2': 'binary_crossentropy'},
              loss_weights={'branch1': 1.0,
                            'branch2': 0.5},
              optimizer='adam',
              metrics={'branch1': 'accuracy',
                       'branch2': ['binary_crossentropy', 'mse']}
)

model.fit(x_train,
          {'branch1': y_train, 'branch2': x_train},
          batch_size=batch_size,
          epochs=epochs,
          validation_data= (x_test,
                            {'branch1': y_test, 'branch2': x_test}
                           ),
          verbose=1
)
```

$$L_{total} = \sum_i w_i L_i.$$

Compile with different learning rates for each task head

```
multipliers = {'dense_1': 0.5, 'dense_2': 0.4}
opt = LearningRateMultiplier(SGD, lr_multiplier=multipliers, lr=0.001, momentum=0.9)
```

Week 7: Building a training dataset

Steps in building a dataset

- Collect the data
  - Decide the number of classes
  - Balance the data
- Annotate the data
  - How to store the data?
  - Method 1: Subfolder name = name of class
  - Method 2: Image folder + a groundtruth file
- Split data
  - Train/Validation/Test
- Start building classification model

Tools to collect image data

- Scraping from the Internet
  - Google Image
  - Bing (for example: https://www.pyimagesearch.com/2018/04/09/how-to-quickly-build-a-deep-learning-image-dataset/)
- Using existing datasets
  - Open Images: 15 millions with 600 categories
  - ImageNet: 14 millions, 1000 categories

Make train/val/test data

- What is the most important thing to check?

Mid-term groups & schedule

Mid-term registration

- <u>Form</u> to register groups: <u>https://forms.gle/BgAWdsCjHgD1nwoA6</u> Closed!
- Spreadsheet to change datasets, submit references, etc.
  - Edit with care!!!! (don't change things that do not belong to you)
  - <u>https://docs.google.com/spreadsheets/d/1HtpFzZUsacJqzrSXr66nnN8V1TB8ErnvCgrB3V07mqo/edit?usp=sharing</u>

Registered IDs

Wrong ID: '16922417'
→ Should be: '16022417'

Not registered IDs: '16020209', '16020230', '16020287', '16020397', '16022494'

Mid-term requirements for each group

- Presentation: 30 mins
  - Talk: 15-20 mins
  - Q&A: 15-10 mins
- Report: 4-8 A4-pages
  - Font: 12-13, Arial

Schedule

| Week	Group	# of members	Dataset	Note
Week 8, Oct 16, 2019	TripleA	5	iWildCam 2019 – FGVC6	kaggle → check if peer-reviewed papers exist
	thức khuya	4	PASCAL VOC 2012	
Week 9, Oct 23, 2019	Nam Nguyễn & Friends	4	Microsoft Malware	kaggle – but, not image classification!!!
	WjbuPride	5	PASCAL VOC 2012	
	Four_frogs	4	CIFAR-100	
	The T Company	5	global terrorist database	image??
Week 10, Oct 30, 2019	Tiger Beer	4	Plant Seedlings classification	kaggle → check if peer-reviewed papers exist
	Heineken	4	CIFAR-10	
	F & Đồng bọn	4	SVHN	object recognition problem
	T' Bros	4	MNIST	
Week 11, Nov 6, 2019	No hope	5	ASL alphabet	kaggle → check if peer-reviewed papers exist
	Fountain Valley-ers	3	tbd	
	Tâm Thi	5	tbd	

How to write a report

Academic report

1. Introduction
   1. Statement of objectives
   2. Definition of classes (if not obvious)
   3. Origin (who made it, when it was made, how it was collected, ...)
   4. Some statistics about labels (how many)
   5. Analysis of the dataset (the amount of data is enough? The consistency of labeling...)
2. Methods
   Clarify the metrics used to evaluate and compare
   Summarize all researches have been done using the datasets and their achievements
   Analyze the pros & cons of each method
3. Implementation
   Reproduce & test results
4. Discussion & Conclusions
   Which improvement can be made
5. References

Reference - citation format
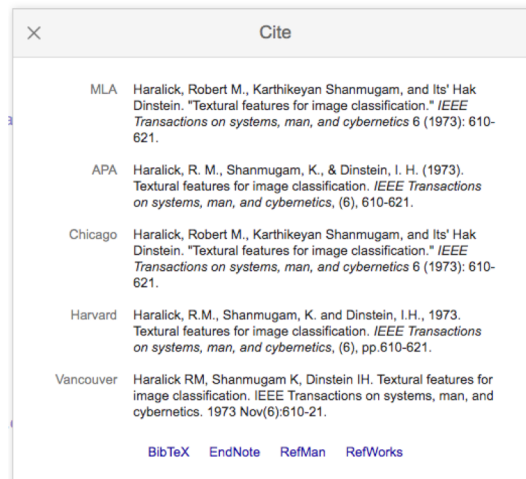
Reference – how to cite a work?

ACM, IEEE, …

1. Using #'s, like [1] or [6,7]
2. Using short strings like [SM15] or [Bob14]
3. Using author-date style, like Smith (2015) or (Smith 2015).

More effective for readers

Best practices

- Use a lot of proper graphics (tables, graphs, plots)
- Use formal definitions whenever possible