HW6 - Adversarial Attack

ML TAs

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Outline

- Task Description
- Data Format
- HW website
- Submission Format (Code, Report)
- Regulations
- Grading Policy & Deadline
- FAQ

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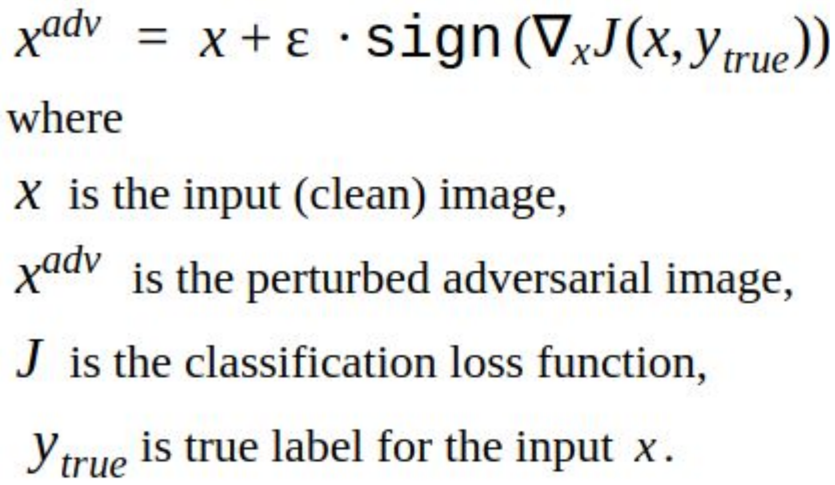
Task Description - Todo 1/3

1. Fast Gradient Sign Method (FGSM)
    1. Choose any proxy network to attack the black box
    2. Implement non-targeted FGSM from scratch
    3. Tune your parameter ε
    4. Submit as hw6_fgsm.sh
2. Any methods you like to attack the model
    1. Implement any methods you prefer from scratch
    2. Beat the best performance in hw6_fgsm.sh
    3. Beat your classmates with lower L-inf. Norm and higher success rate
    4. Submit as hw6_best.sh

Task Description - Fast Gradient Sign Method 2/3

- Fast Gradient Sign Method (FGSM)



$$x^{adv} = x + \varepsilon \cdot \mathtt{sign}(\nabla_x J(x, y_{true}))$$

where

x is the input (clean) image,

x^{adv} is the perturbed adversarial image,

J is the classification loss function,

y_{true} is true label for the input x.

Explaining and Harnessing Adversarial Examples: https://arxiv.org/pdf/1412.6572.pdf
Adversarial Machine Learning at Scale: https://arxiv.org/pdf/1611.01236.pdf

Task Description - Evaluation Metrics 3/3

- Average L-inf. norm between all input images and adversarial images
- Success rate of your attack
- Priority: Success rate > Ave. L-inf. norm

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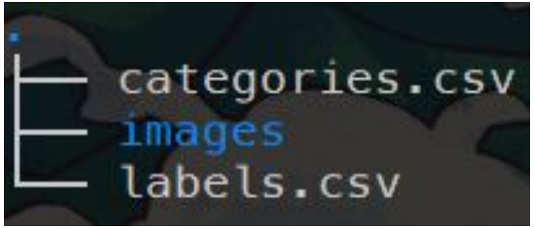
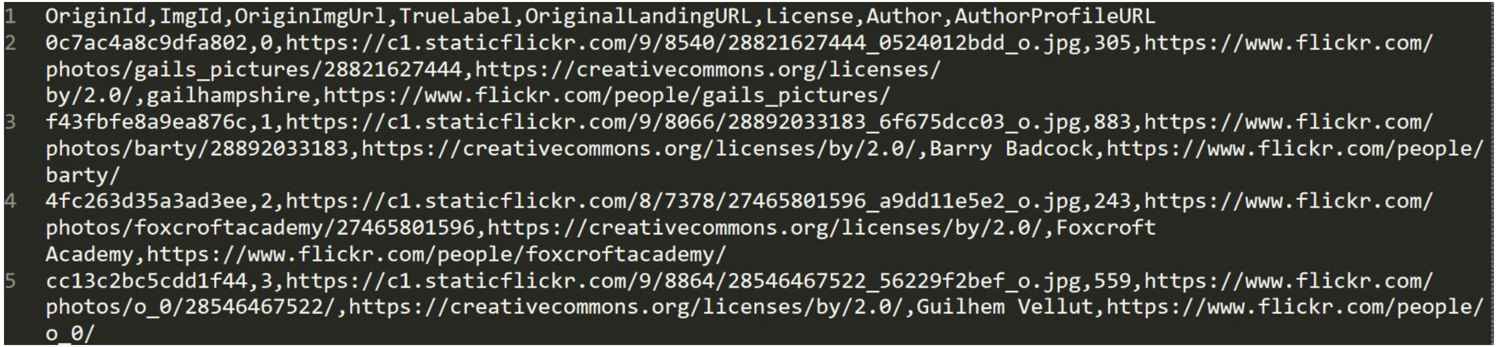
Data Format 1/2

- Download link: link
- Images:
  - 200 張 224 * 224 RGB 影像
    - 000.png - 199.png
  - categories.csv: 總共 1000 categories (0 - 999)
  - labels.csv: 每張影像的 info



```
├── categories.csv
├── images
└── labels.csv
```



```
OriginId,ImgId,OriginImgUrl,TrueLabel,OriginalLandingURL,License,Author,AuthorProfileURL
0c7ac4a8c9dfa802,0,https://c1.staticflickr.com/9/8540/28821627444_0524012bdd_o.jpg,305,https://www.flickr.com/
photos/gails_pictures/28821627444,https://creativecommons.org/licenses/
by/2.0/,gailhampshire,https://www.flickr.com/people/gails_pictures/
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photos/barty/28892033183,https://creativecommons.org/licenses/by/2.0/,Barry Badcock,https://www.flickr.com/people/
barty/
4fc263d35a3ad3ee,2,https://c1.staticflickr.com/8/7378/27465801596_a9dd11e5e2_o.jpg,243,https://www.flickr.com/
photos/foxcroftacademy/27465801596,https://creativecommons.org/licenses/by/2.0/,Foxcroft
Academy,https://www.flickr.com/people/foxcroftacademy/
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photos/o_0/28546467522/,https://creativecommons.org/licenses/by/2.0/,Guilhem Vellut,https://www.flickr.com/people/
o_0/
```

Data Format 2/2

- 本次作業可以使用其他現成 pretrained 模型進行攻擊
- Black box 可能的模型如下 :
    - VGG-16
    - VGG-19
    - ResNet-50
    - ResNet-101
    - DenseNet-121
    - DenseNet-169
- Model reference:
    - Keras: https://keras.io/applications/
    - PyTorch: https://pytorch.org/docs/stable/torchvision/models.html
    - Tensorflow: https://github.com/tensorflow/models/tree/master/research/slim

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HW website - JudgeBoi 1/2

- Link: JudgeBoi
- 個人進行，不需組隊
- 以繳交作業的 GitHub 帳號登入，嚴禁多重帳號
- 因為 Kaggle 沒有本作業要用的 evaluation metric，所以本作業使用本課程自行研發的評估平台
- 霸脫不要亂搞QQ，有任何問題請先回報給 TA

HW website - JudgeBoi 2/2

- 請將 200 張生成的 images 壓縮 .tgz 檔格式上傳
- Note: 解壓縮後不能包含資料夾
- E.g.,
  - cd <your output image file>
  - tar -zcvf <compressed file> <all images>
  - Ex. tar -zcvf ../images.tgz *.png
- 每日上傳上限 5 次 (更新時間為每天 00:00:00)
- 結束前請在 My submission 內選擇一個結果當作最後的結果，若沒勾選會自動選擇最新上傳的

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Submission Format - GitHub 1/2

- GitHub 中 hw6-<account> 必須包含（注意格式）:
  - report.pdf
  - hw6_fgsm.sh
  - hw6_best.sh
  - other files (e.g., attack.py)
  - 請不要上傳 dataset 和 output img
  - 如要上傳 model file，請上傳至雲端 (Dropbox, ...)，並在 script 中寫好下載的指令

Submission Format - Bash Usage 2/2

- 助教會以下指令執行程式，程式執行時間最多不能超過 **300** 秒
    - timeout 300 bash hw6_fgsm.sh <input dir> <output img dir>
    - timeout 300 bash hw6_best.sh <input dir> <output img dir>
    - input directory: 作業提供的 data 資料夾
    - output img directory: 為 200 張 adversarial output img 之資料夾
    - Ex. bash hw6_fgsm.sh ./data ./output
- Output file 中的 img 格式如同 input img
    - E.g., ./output/000.png
- 路徑請勿寫死以免導致程式無法執行

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Regulations

- Python 版本及套件規定請參考期初公告
  - 建議不要使用 Keras，它的 pretrained model 在本次作業中不是好的 proxy model
  - **不得使用** cleverhans、deepfool、adversarial-robustness-toolbox 以及任何現成套件。
- 若需使用其它套件，請儘早寄信至助教信箱詢問，並闡明原因。

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Grading Policy - Evaluation (4% + 1% bonus) 2/7

- (2%)
  - success rate 高於 simple baseline
  - L-inf.norm 低於 simple baseline
- (2%)
  - success rate 高於 strong baseline
  - L-inf.norm 低於 strong baseline
- Simple baseline
  - Success rate: 0.310
  - L-inf. norm: 20.3450
- Strong baseline
  - Success rate: 0.915
  - L-inf. norm: 9.5
- (1% bonus) L-inf.norm 低於 strong baseline 的 submission 中的前五名

Grading Policy - Reproduce 3/7

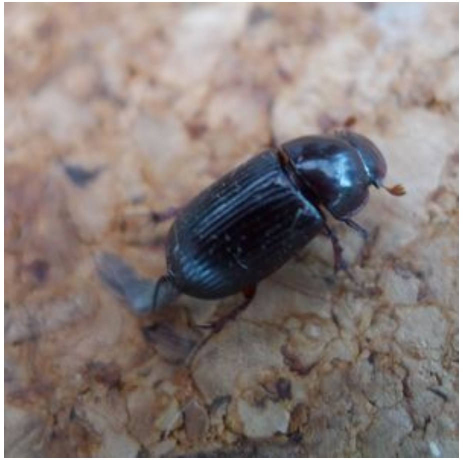
- 請務必隨時保留跑出最佳結果的 code 和結果
- hw6_best.sh 執行後產生的 image, evaluation metric 需與 leaderboard **上一致**, 否則 evaluation 的成績將**不予計分**

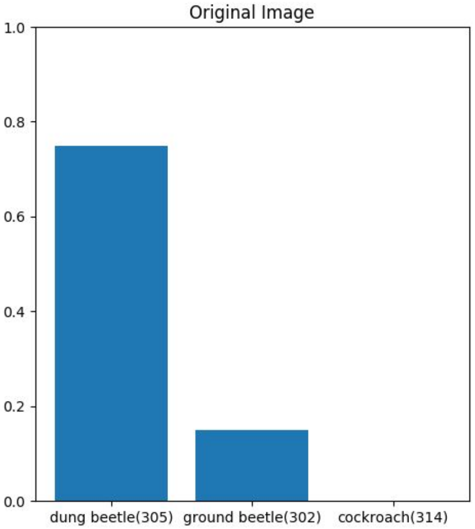
Grading Policy - Report (6%) 4/7

1. (2%) 試說明 hw6_best.sh 攻擊的方法，包括使用的 proxy model、方法、參數等。此方法和 FGSM 的差異為何？如何影響你的結果？請完整討論。(依內容完整度給分)
2. (1%) 請嘗試不同的 proxy model，依照你的實作的結果來看，背後的 black box 最有可能為哪一個模型？請說明你的觀察和理由。

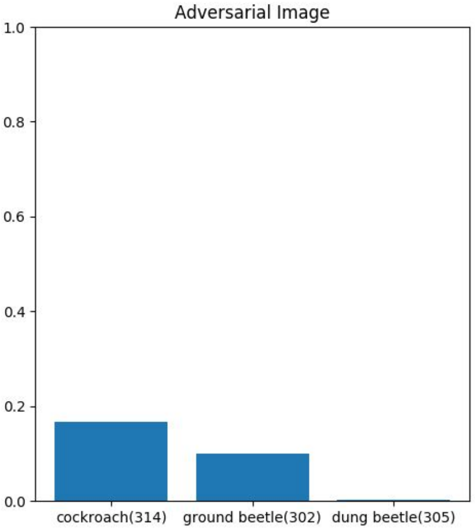
Grading Policy - Report (6%) 5/7

3. (1%) 請以 hw6_best.sh 的方法, visualize 任意三張圖片攻擊前後的機率圖(分別取前三高的機率)。





Dung beetle 74.85%



Cockroach 16.65%

Grading Policy - Report (6%) 6/7

4. (2%) 請將你產生出來的 adversarial img，以任一種 smoothing 的方式實作被動防禦 (passive defense)，觀察是否有效降低模型的誤判的比例。請說明你的方法，附上你防禦前後的 success rate，並簡要說明你的觀察。另外也請討論此防禦對原始圖片會有什麼影響。

Hint: some methods you may use:

- Gaussian filtering: link
- Median filter: link
- Bilateral filter: link
- Others: link

Useful Links

- Data: https://reurl.cc/vD3Yr1
- Colab: https://reurl.cc/Mv1pnn
- 作業網站: https://reurl.cc/exvR0R
- Report: https://reurl.cc/O17Zlr
- 遲交表單: https://bit.ly/39d2x2m

FAQ

- 若有其他問題，請在 FB 社團貼文或寄信至助教信箱，請勿直接私訊助教。
- 助教信箱：ntu-ml-2020spring-ta@googlegroups.com
- 並請記得於標題以 [hw6] 註明作業編號。