CS772: Research Project

Zero Shot Machine Unlearning

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Problem Statement

- Machine Unlearning
  - Model M, Data D
  - Request:
    - Forget Data $D_f \subset D$
    - Retain Data $D_r = D - D_f$
  - Gold / Retrained Model: M^*
  - Unlearned Model: M_u
  - Aim: $M_u(x) \approx M^*(x)$

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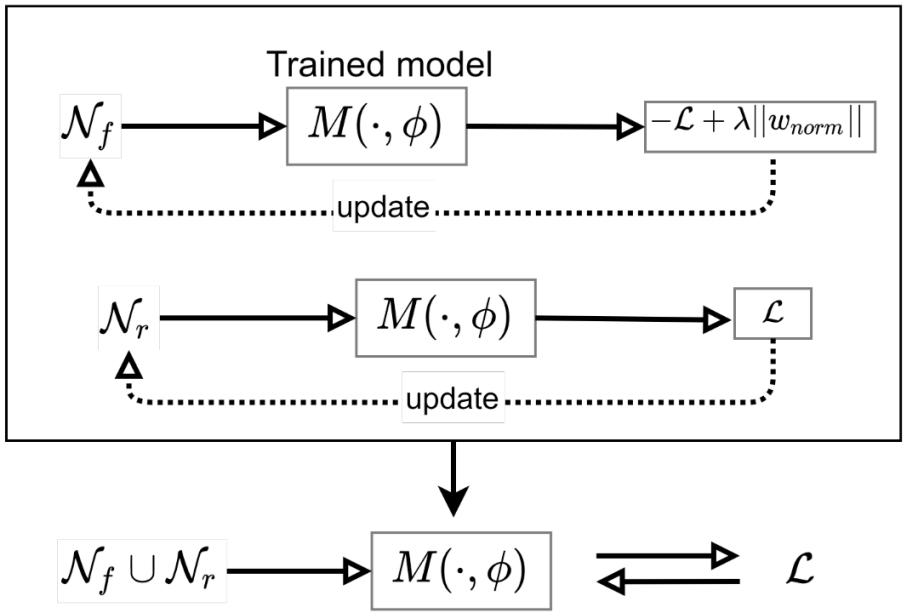
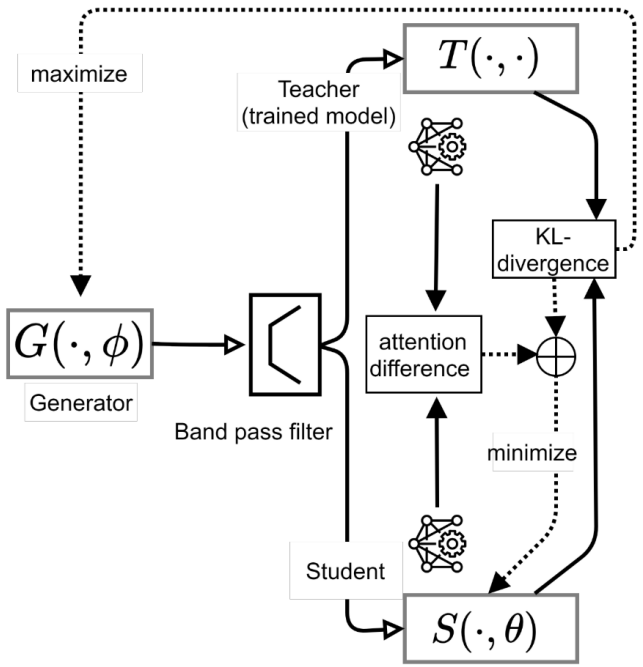
  - Aim: $M_u(x) \approx M^*(x)$
- Zero-Shot Machine Unlearning
  - No Access to D_f and D_r
- Proposes two approaches - restricted setting of classification
- Setting
  - Set of Forget C_f and Retain Classes C_r

Error Minimization-Maximization Noise



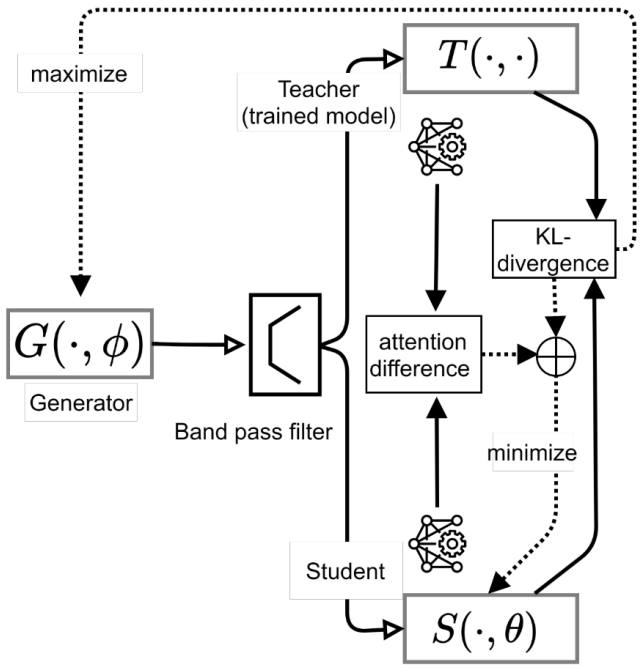
- Anti-Samples N_f learnt by maximising loss
- Data representatives N_r learnt by minimising loss
- Updates the original model using noise

Gated Knowledge Transfer



- Knowledge Distillation to train the student from teacher

Gated Knowledge Transfer



- Knowledge Distillation to train the student from teacher
- Student - Minimise KL
- Attention - Mimic Inner Layers
- Generator: Max $D_{KL}(T(x_g)||S(x_g)) = \sum_i^{|C|} t_p^{(i)} \log(t_p^{(i)}/s_p^{(i)})$
- Filter images belonging to C_f

Entropy Criterion

- Entropy of predictions
  - Reject if $S(t_p) > \epsilon$
  - Faster Retain Accuracy Restoration
  - Poorer Retain Accuracy
  - Carrying out experimentations

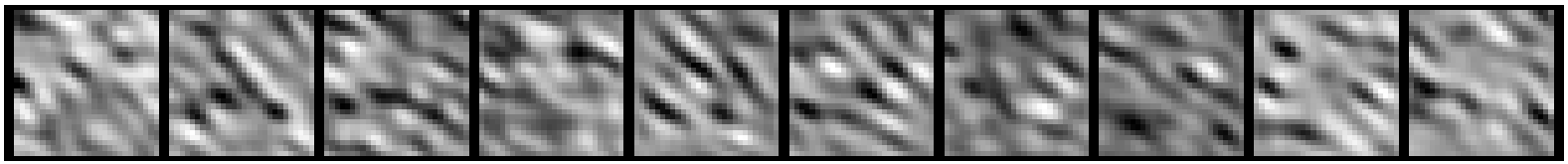
Deep Inversion

- Difference in M^* and M_u
  - Non-zero Accuracy for C_f
  - Due to Attention implicitly learn for C_f
  - Removing Attention: Impacts Performance
  - Reason: Poor Generated Images
  - Deep Inversion
  - Much Better Images

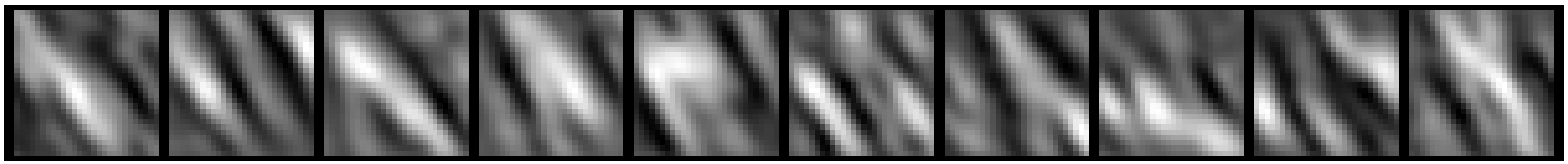
Generated Images

MNIST Numbers Dataset
Images of Digits from 0-9

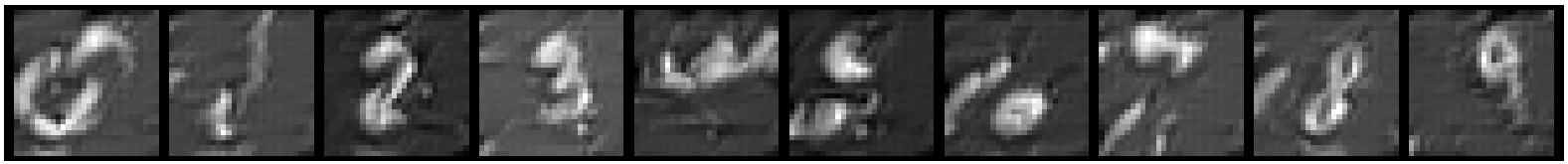
- GKT*



- GKT (with entropy criterion)*



- Deep Inversion



* Images not in order from 0-9. Images generated by the generator before forget accuracy begin to rise

Experimental Results

MNIST Numbers Dataset - `AllCNN` Model
Train: 60,000, Test: 10,000
Retain Accuracy on Test Set:

- Retrain Model: 99.25 %
- GKT: 97.12 %
- M-M: 10.57 %

Experimental Results

MNIST Numbers Dataset - `AllCNN` Model
Train: 60,000, Test: 10,000
Retain Accuracy on Test Set:

- Retrain Model: 99.25 %
- GKT: 97.12 %
- M-M: 10.57 %
- GKT (no attention): <50 %
- Deep Inversion (100 sample/class): 40 - 50 %
- Deep Inversion (6000 sample/class): 80 - 85 %

Conclusion

- Tackling zero-shot setting
- Non-zero forget class accuracy
- Quality of images generated
- Decent Results

Learnings

- First research experience
- Ability to read papers
- Tweaking complex machine learning code

Thank You