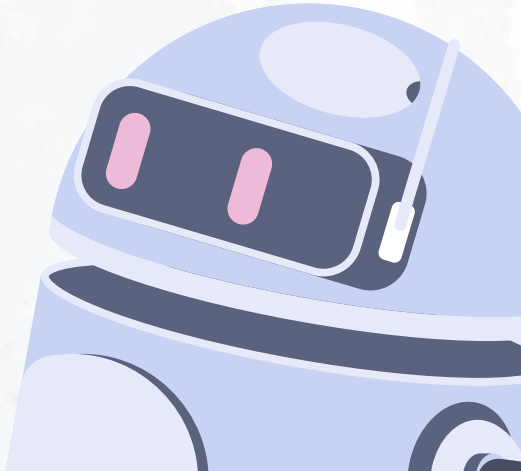
Understanding Deep Learning Requires Rethinking Generalization

ICLR Best Paper Award 2017

Autores: Chiyuan Zhang, Samy Bengio, Moritz Hardt, Benjamin Recht y Oriol Vinyals.



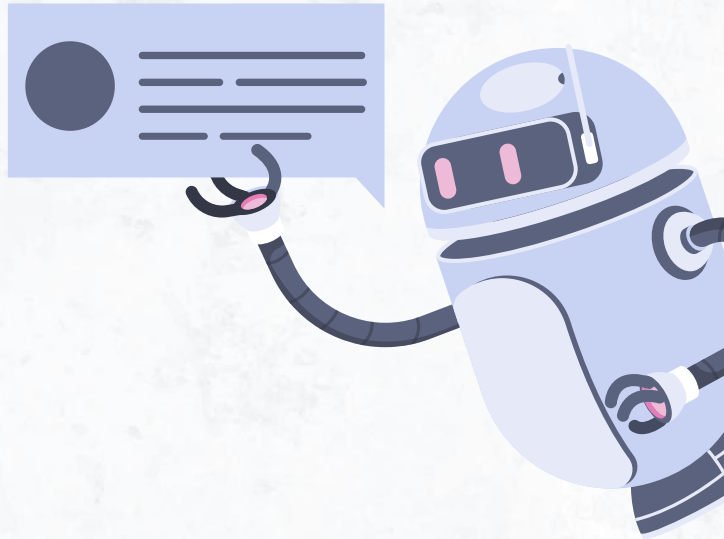
01 →

Motivación

Pregunta:

“What is it then that distinguishes neural networks that generalize well from those that don’t?”

¿Qué es lo que se ha hecho para responder esta pregunta?



Teoría del aprendizaje estadístico

- Dimensión VC
- Complejidad de Rademacher
- Estabilidad Uniforme
- Regularizaciones (implícita y explicita)

Tipos de Regularizaciones

(a) Regularizaciones Explicitas

- **Weight Decay**
- **Dropout**
- **Data Augmentation**

(b) Regularizaciones Implícitas

- **Early Stopping**
- **Batch Normalization**
- **SGD**

02 →

Hallazgos experimentales

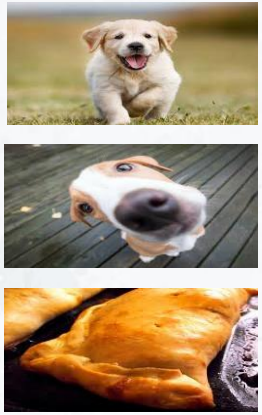
(IA)

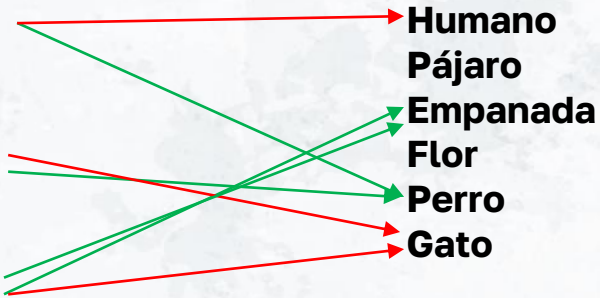
Randomization Tests

Las Redes Neuronales Profundas se ajustan fácilmente a las labels aleatorias

Randomization Tests

- True labels
- Partially corrupted labels
- Random labels

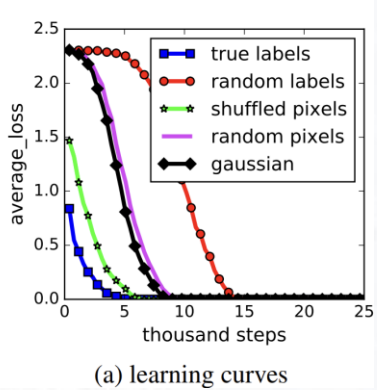




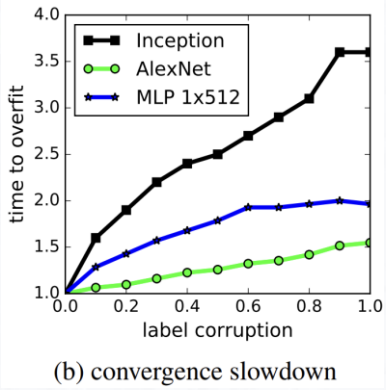
Randomization Tests

- Shuffled pixels
- Random pixels
- Gaussian

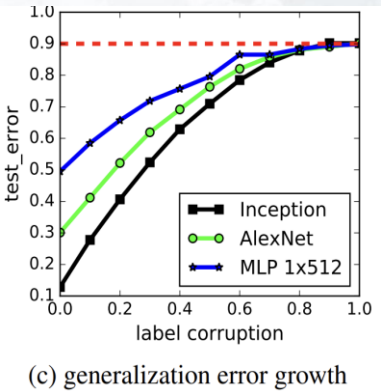
Resultados de Randomization Test



(a) learning curves



(b) convergence slowdown

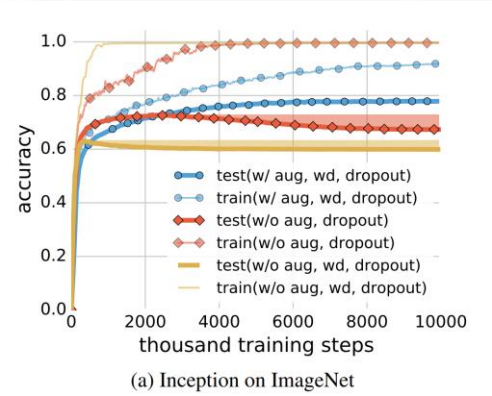


(c) generalization error growth

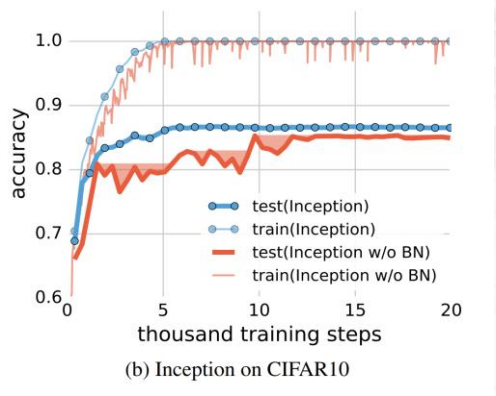
Conclusiones e Implicancias

- Conclusión:
  - Deep Neural Networks **easily fit random labels**.
- Implicancias:
  - The **effective capacity** of neural networks is **sufficient for memorizing the** entire data set.
  - Even **optimization** on random labels **remains easy.**

Resultados Regularization Test



(a) Inception on ImageNet



(b) Inception on CIFAR10

Conclusiones e Implicancias

- Conclusión:
  - Bigger gains by **changing the model architecture**.

- Implicancias:
  - Explicit regularization may improve generalization performance, but is **neither necessary nor by itself sufficient** for controlling generalization error.

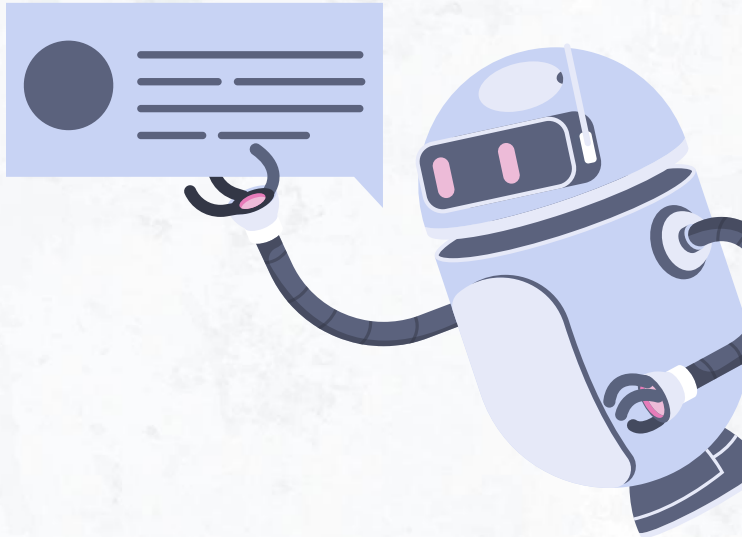
03 →

Conslusión

(IA)

Conclusión

“Both explicit and implicit regularizers… could help to improve the generalization performance. However, it is **unlikely that the regularizers are the fundamental reason for generalization**, as the networks continue to perform well after all the regularizers removed.”



Crítica

- ✓ Explicaron de forma clara por qué las formas tradicionales de medir la complejidad de los modelos tenían problemas para explicar la generalización en large neural networks.
- ✗ No presentan alguna mejor manera de medir la generalización de los modelos.

Gracias!

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