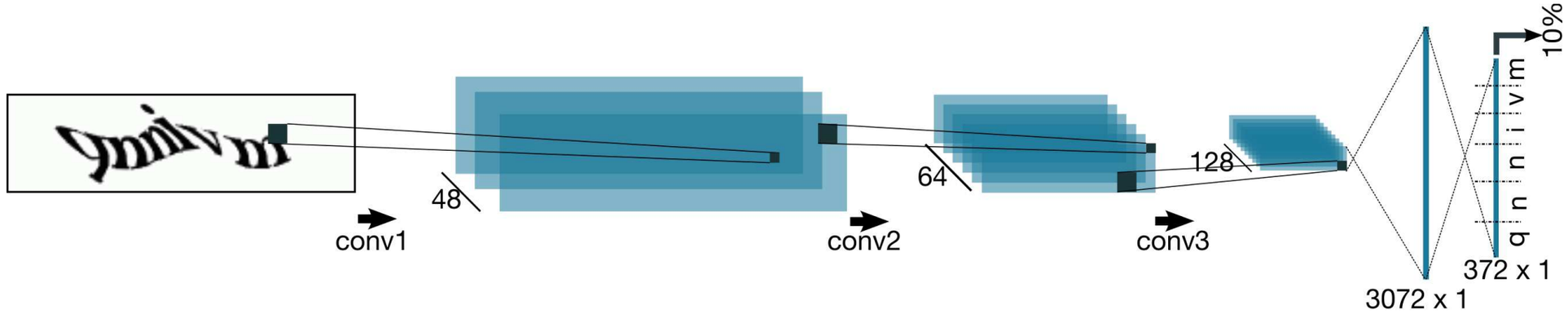
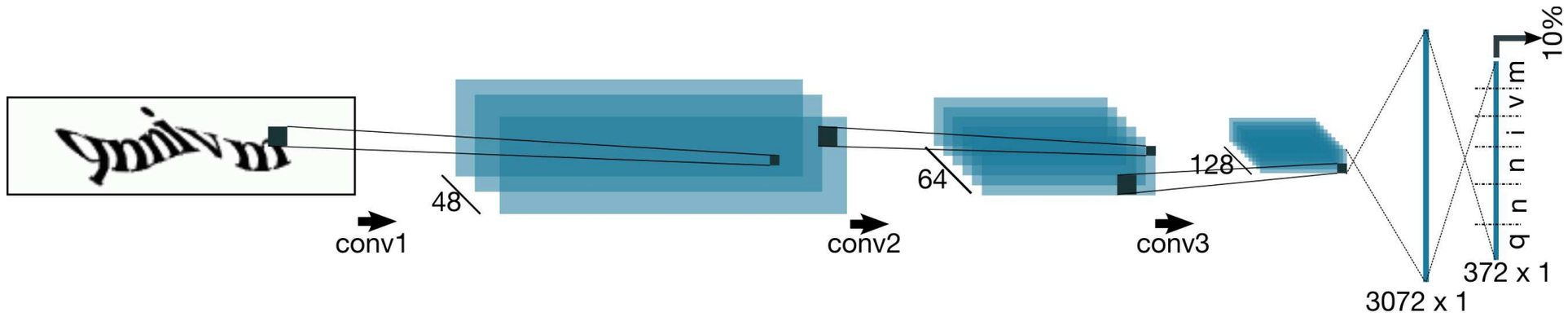
CAPTCHA Recognition with Active Deep Learning

Caner Hazırbaş



Joint work with Fabian Stark, Rudolph Triebel and Daniel Cremers

Deep CNN for CAPTCHA Recognition



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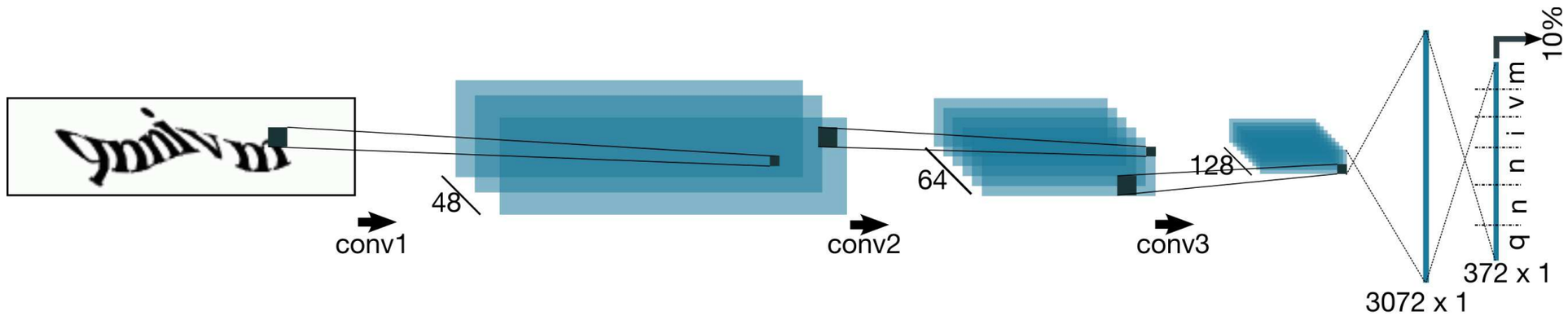
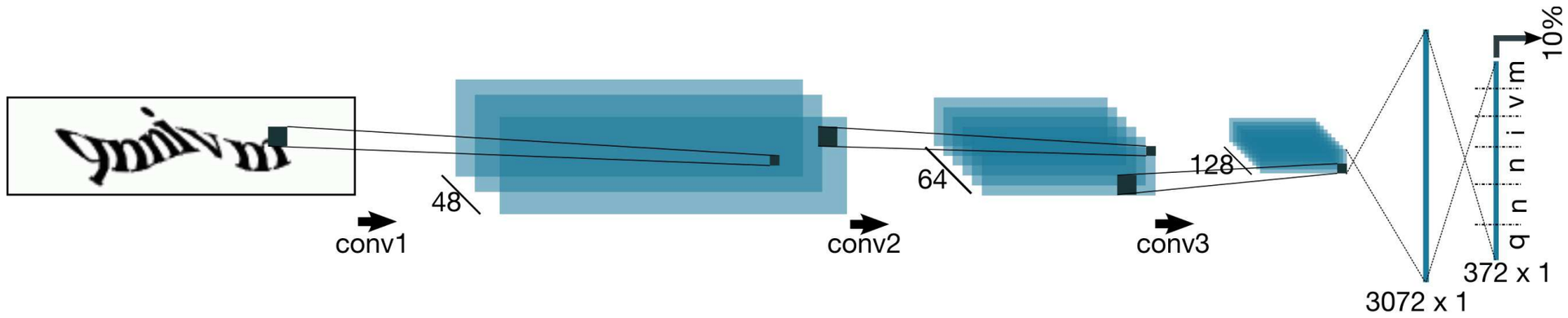


Advantages

- ✓ No pre-segmentation
- ✓ Precise prediction

Deep CNN for CAPTCHA Recognition



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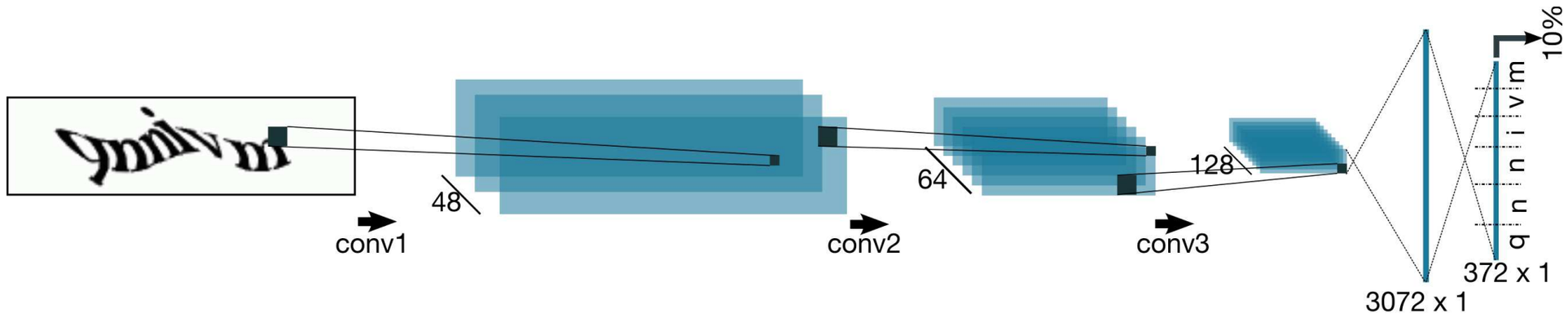
Drawbacks

- ✦ Millions of parameters to learn
- ✦ Need of huge training set

Deep CNN for CAPTCHA Recognition



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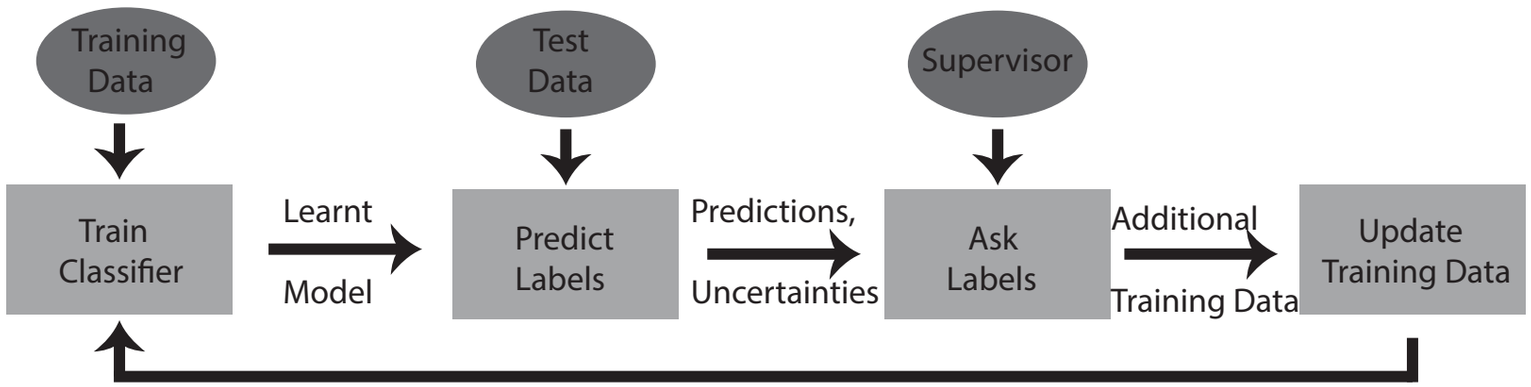
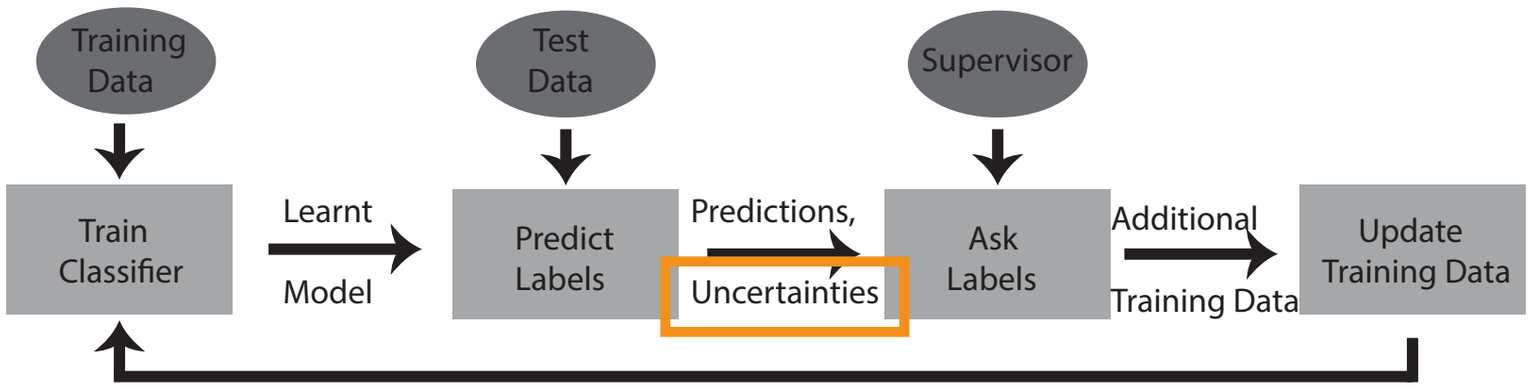
Solution

- ✓ Active Learning:
  - required training data
  - increase the accuracy

Active Learning for CAPTCHA Recognition



Uncertainty Estimation



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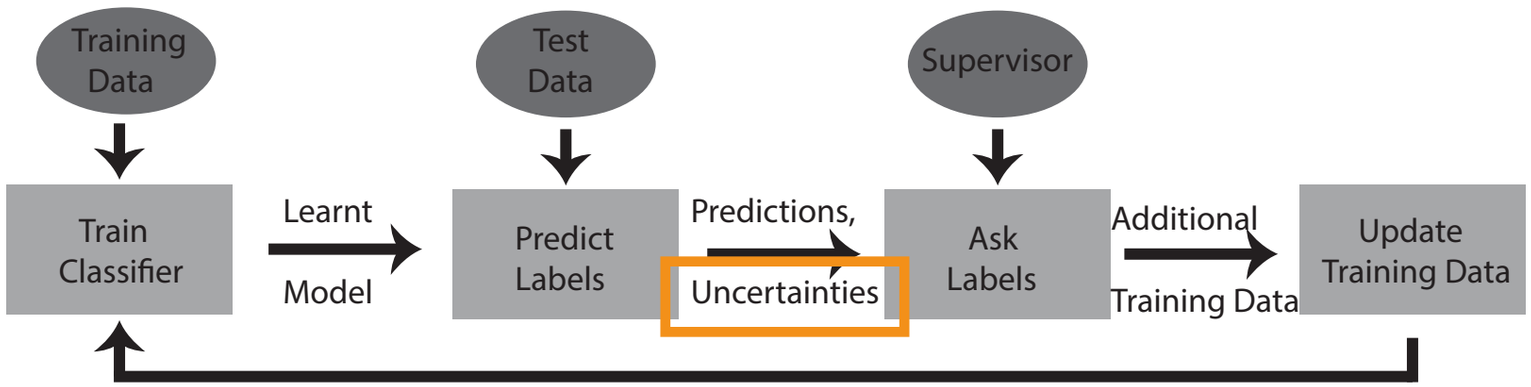
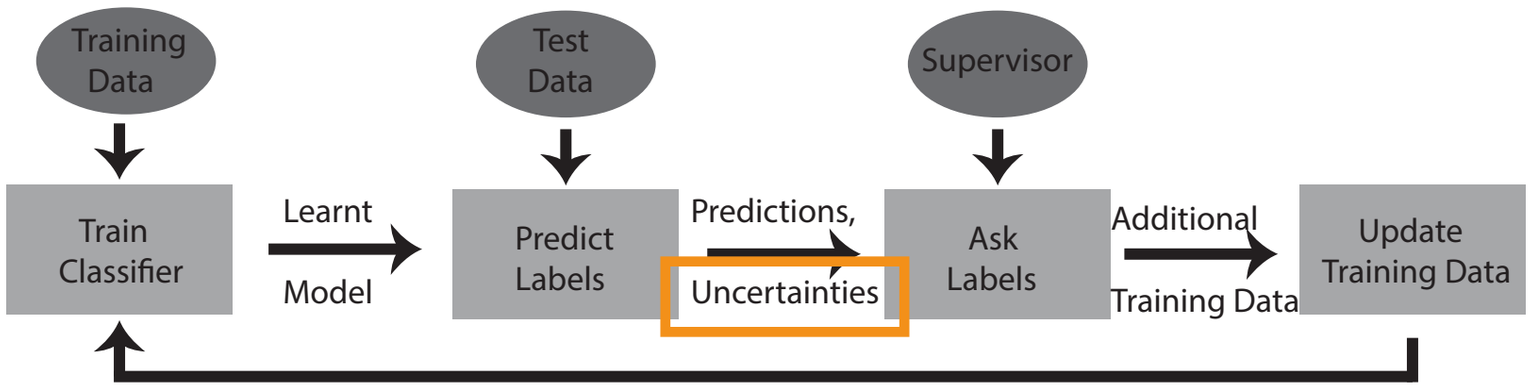


“entropy ?”

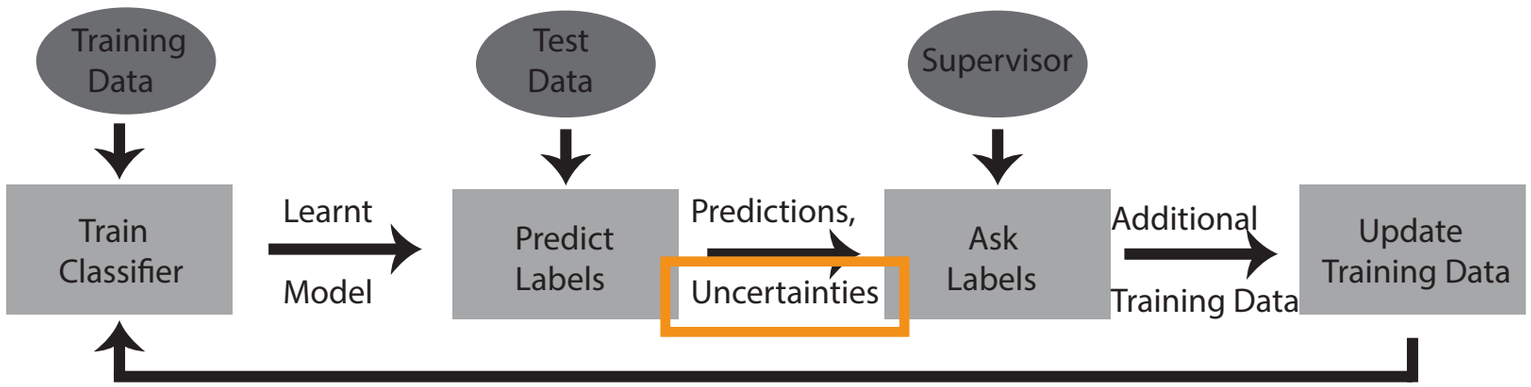
Uncertainty Estimation



“entropy ?”

Not a good measure in the case of multi-class problems !

Uncertainty Estimation



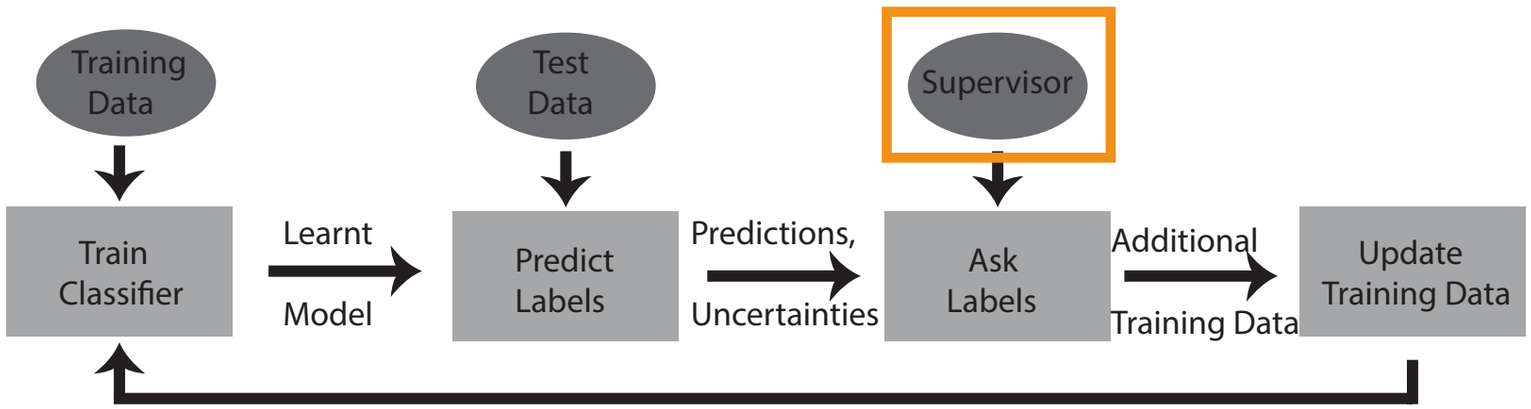
"best-vs-second-best"

$$\eta = \frac{1}{d} \cdot \sum_{i=1}^{d} \frac{\arg\max \mathcal{P}(x_i) \setminus \arg\max \mathcal{P}(x_i)}{\arg\max \mathcal{P}(x_i)}$$

second-best

best

No Human Intervention



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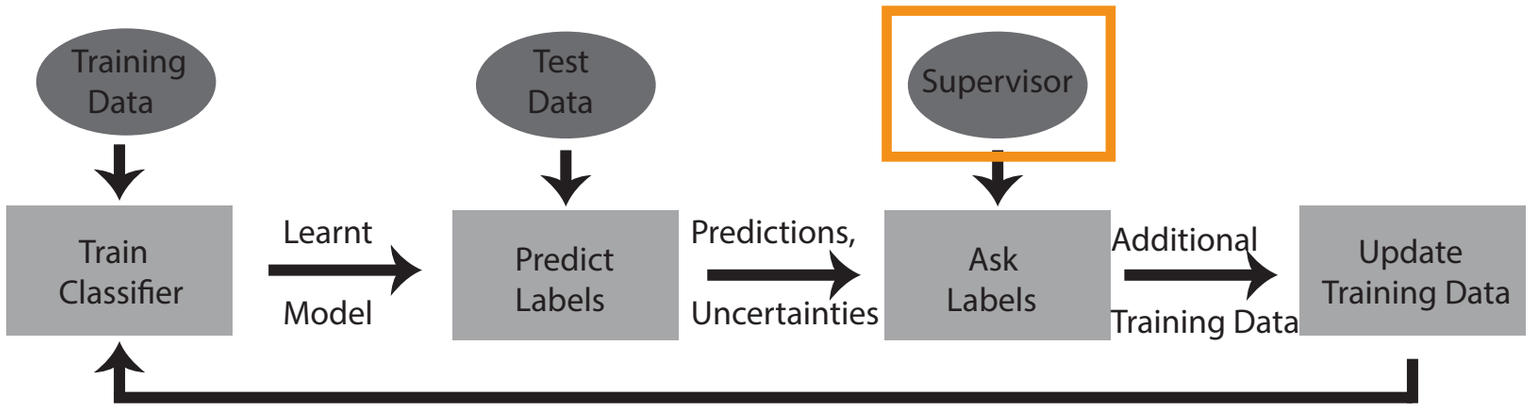

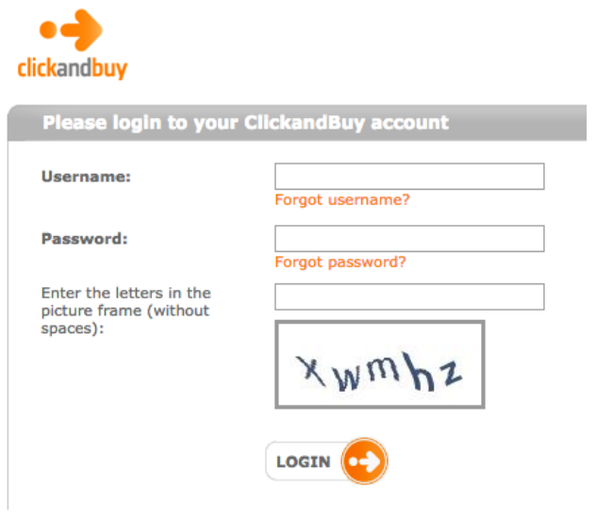

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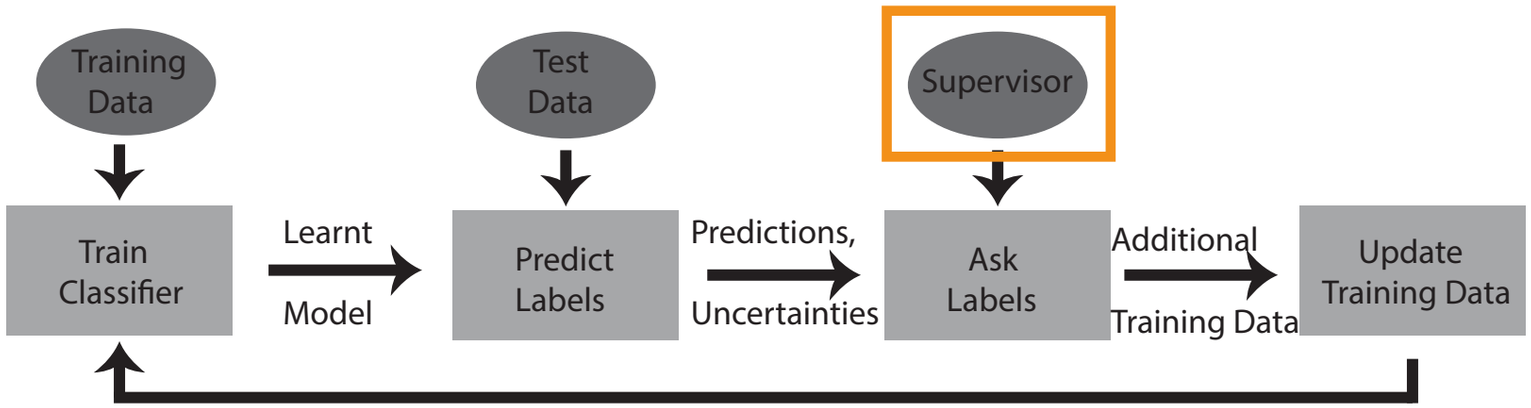

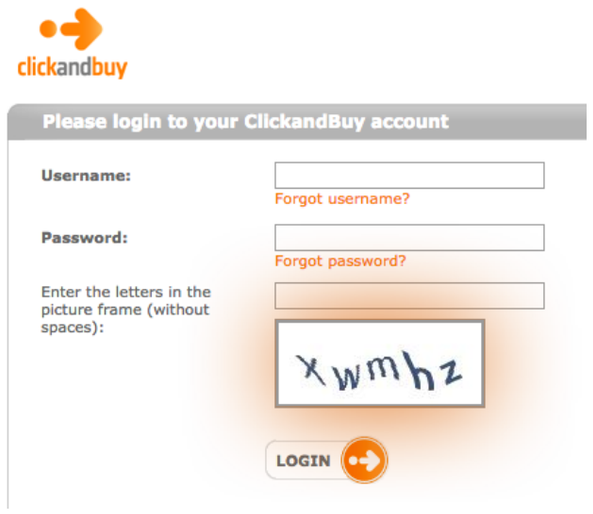

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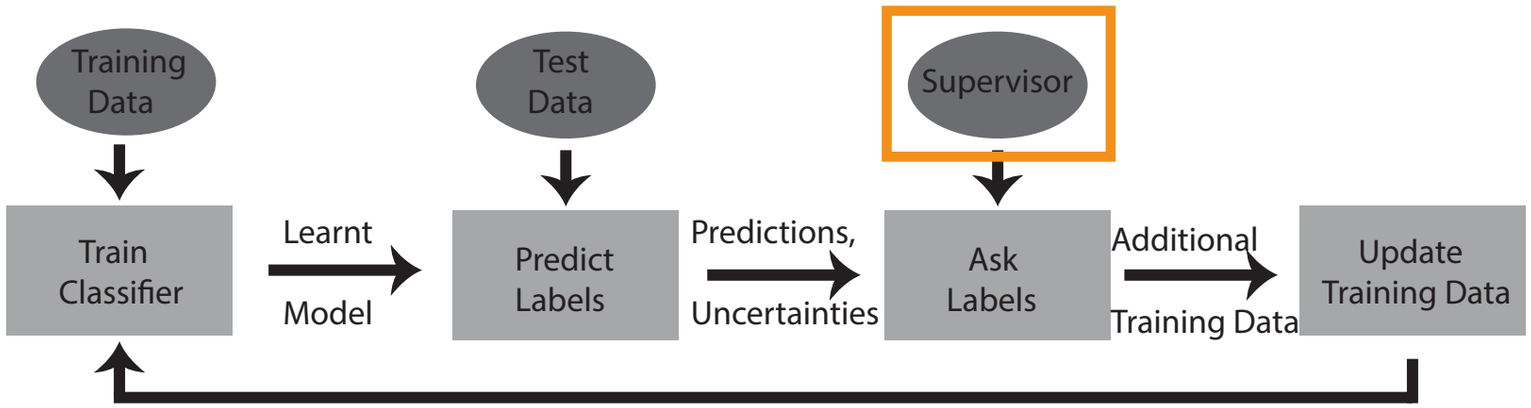

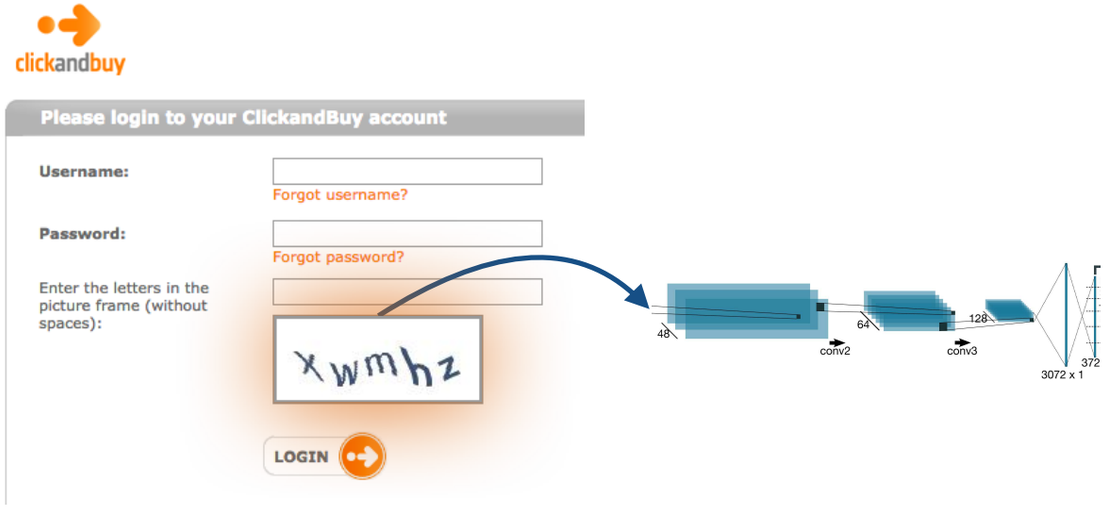

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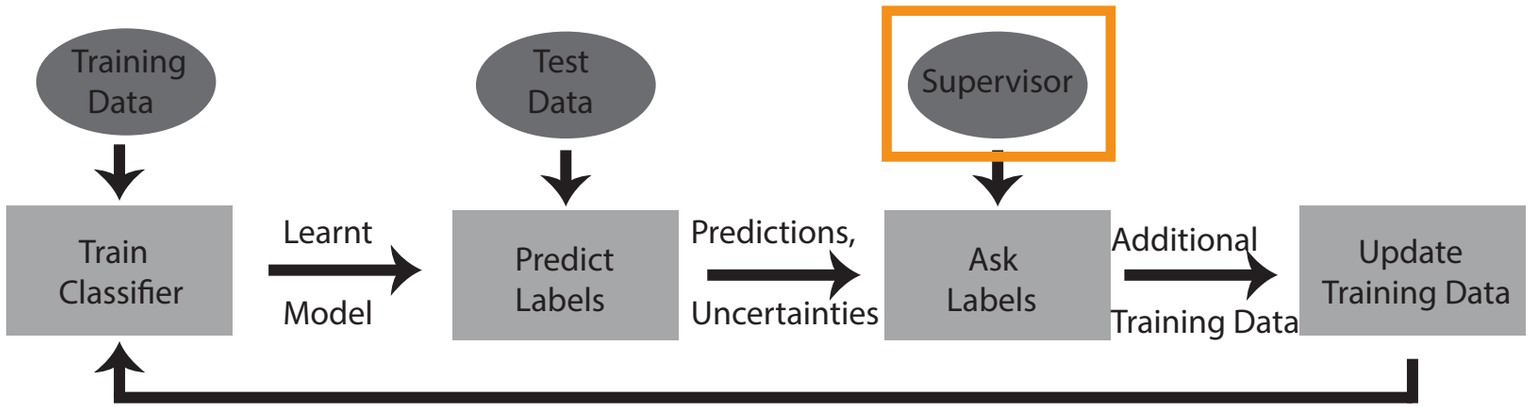

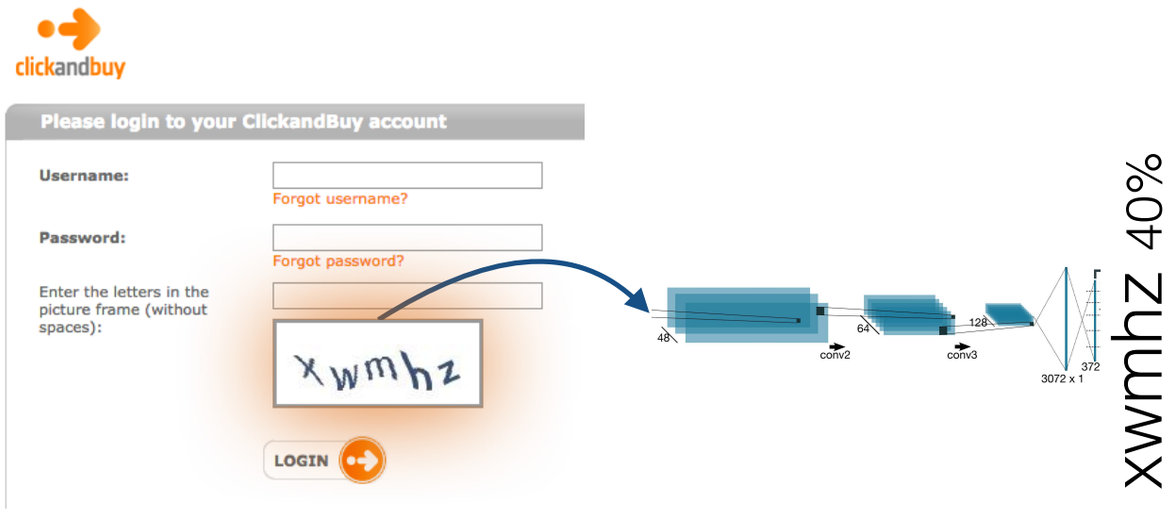

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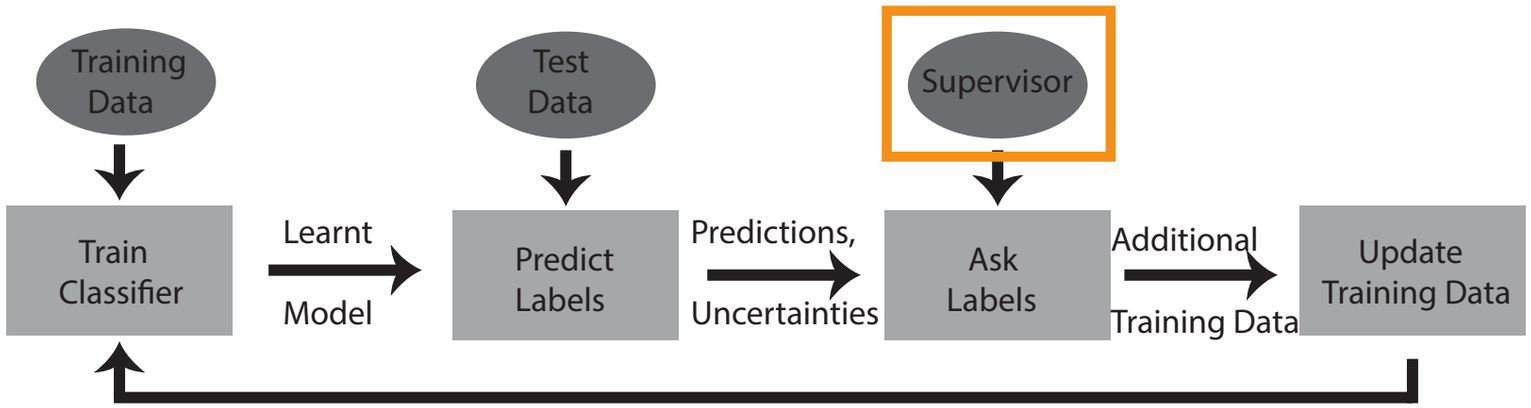

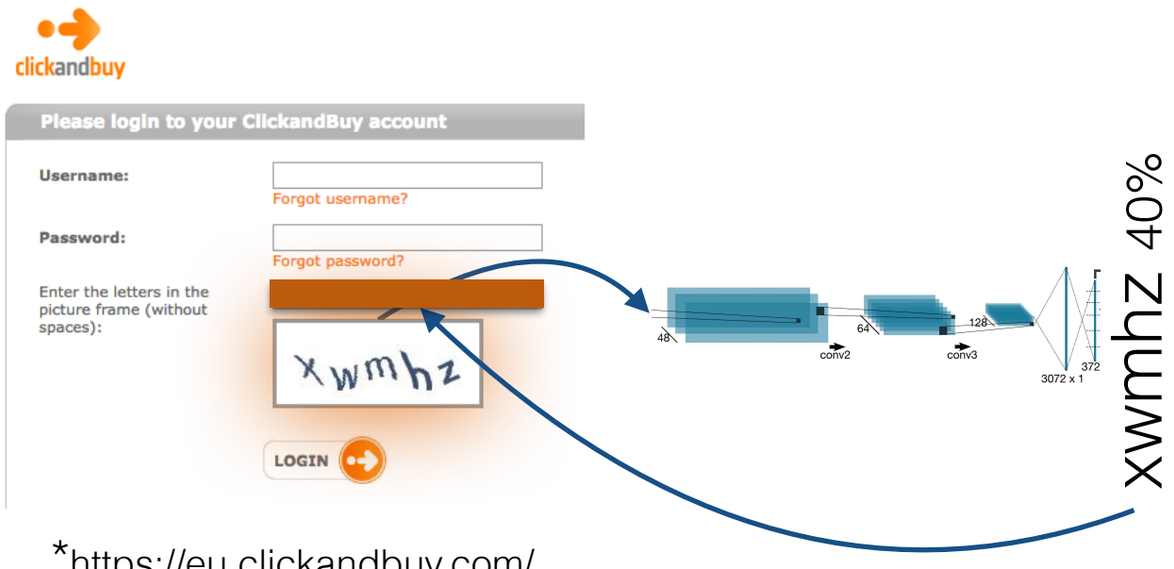

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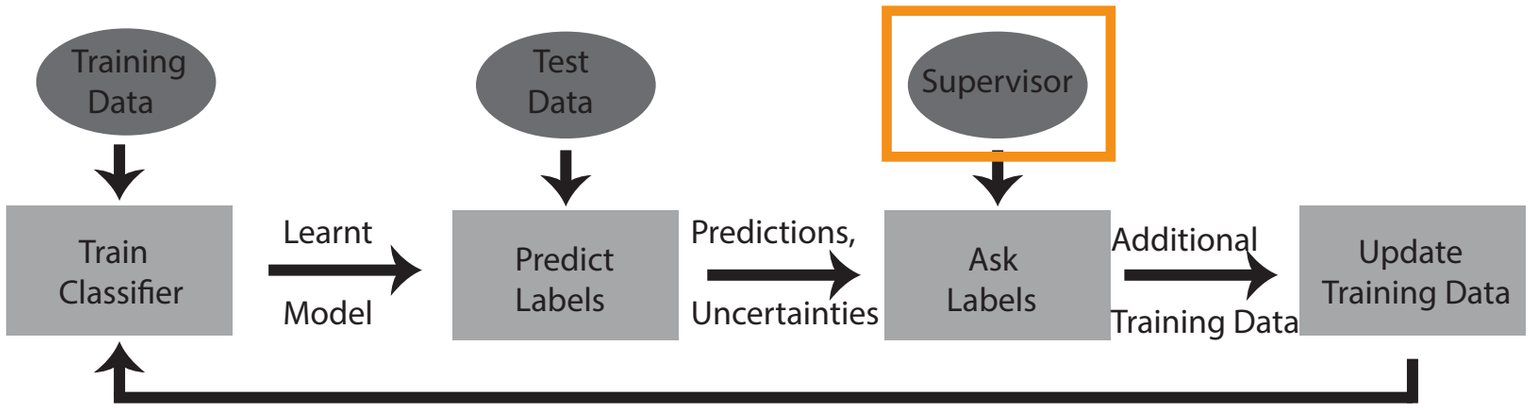

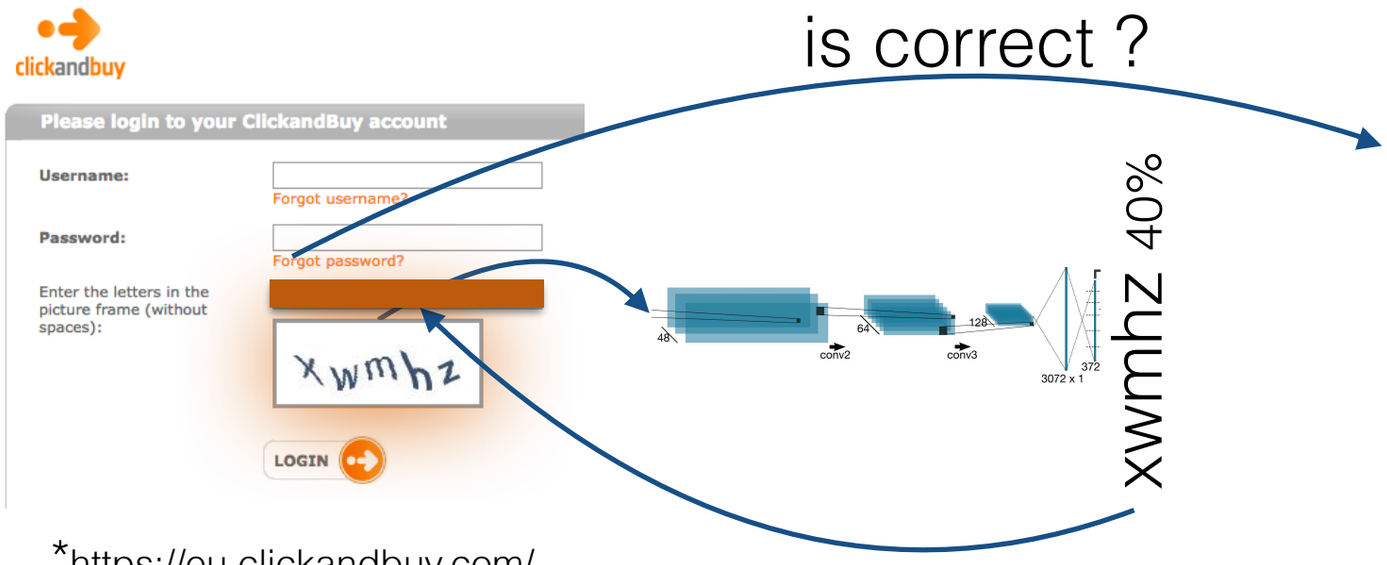

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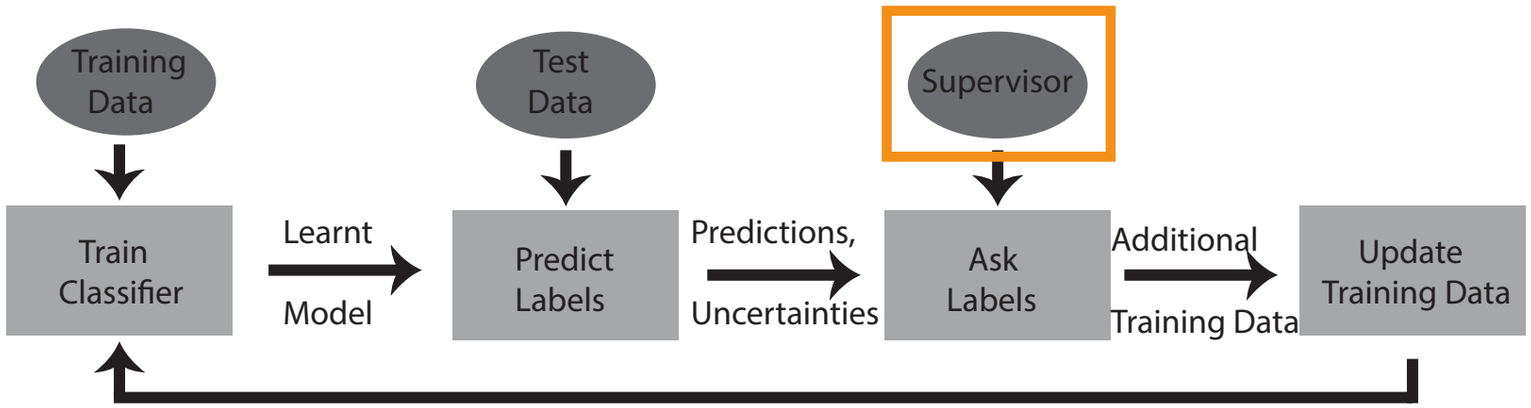

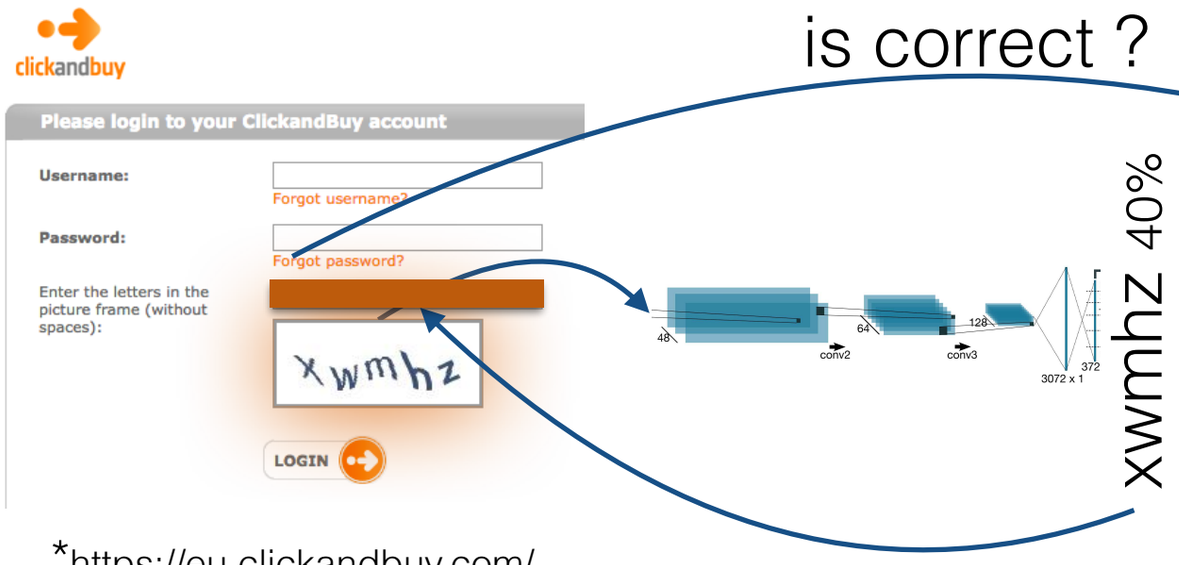

yes —> new training sample
no —> no ground truth :/

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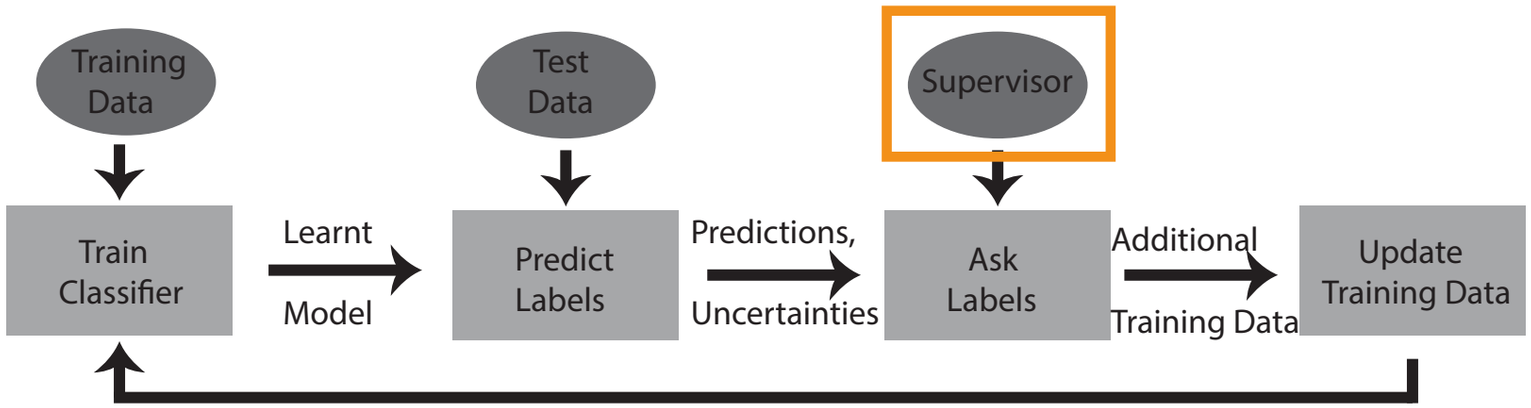

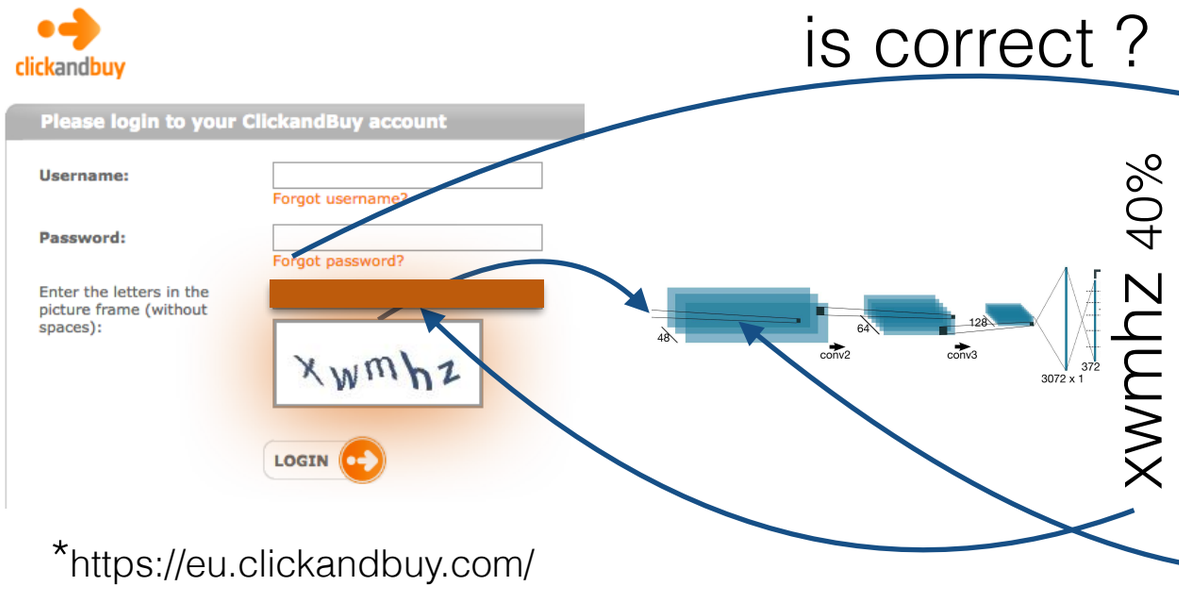

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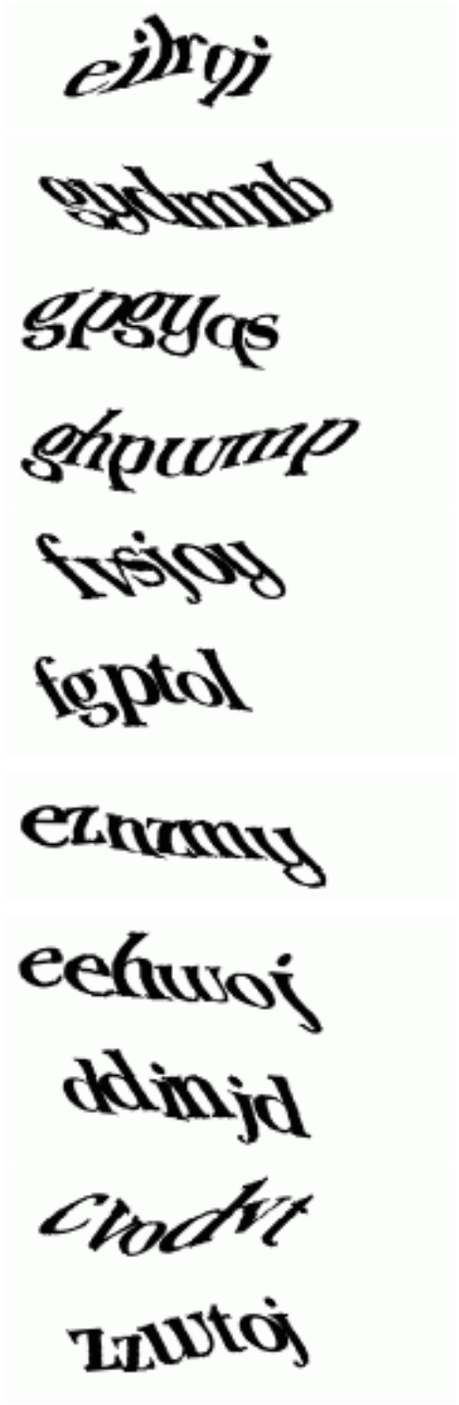
Results on Auto-generated CAPTHAs



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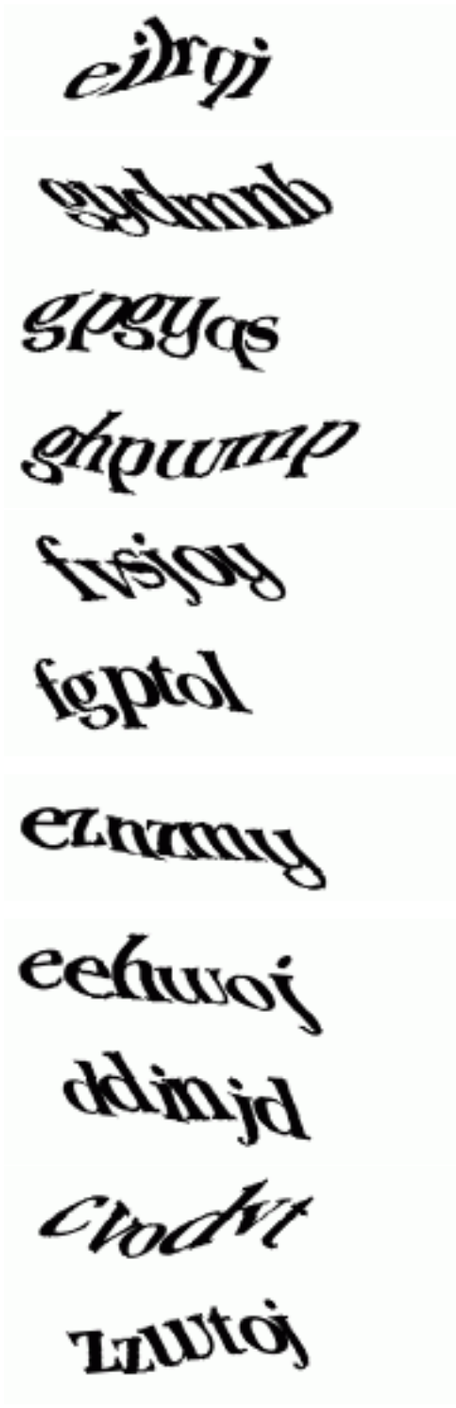
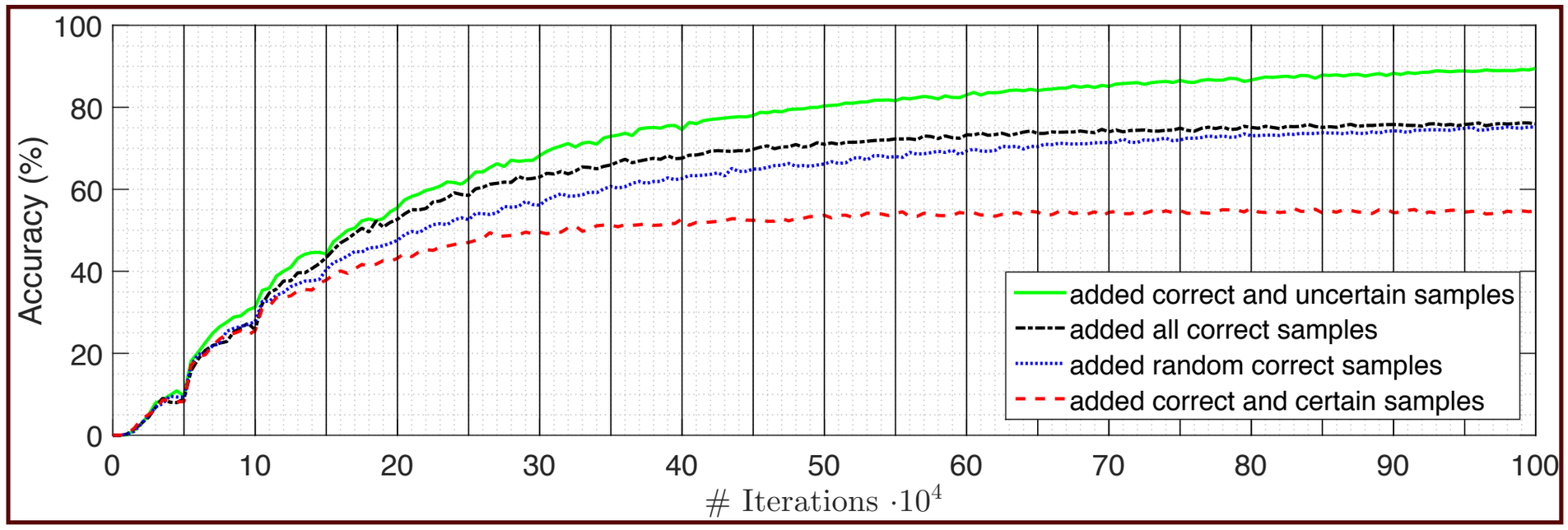


Increasing training set



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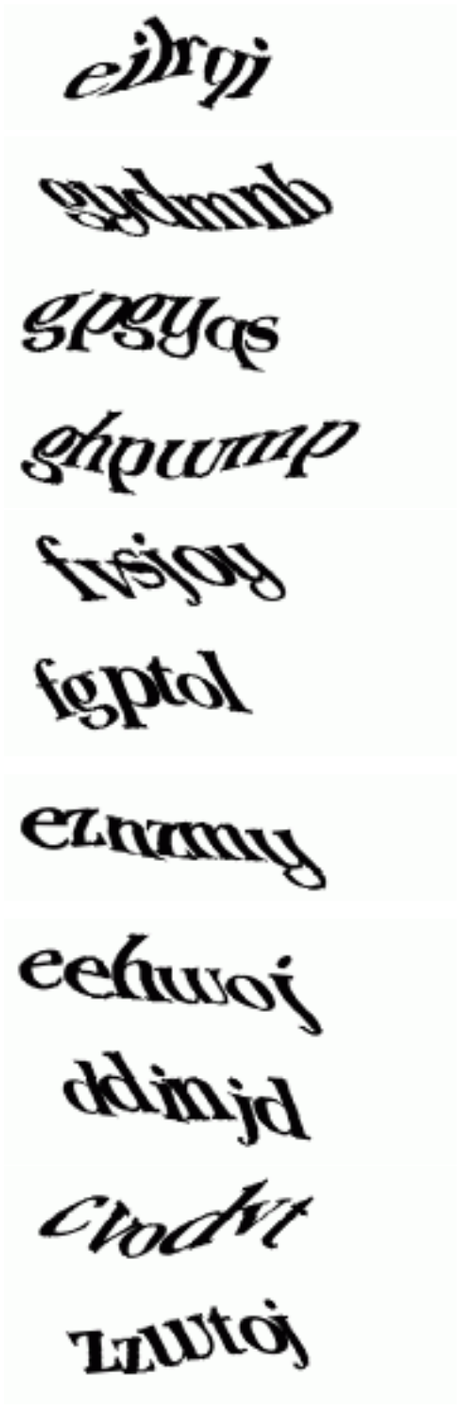

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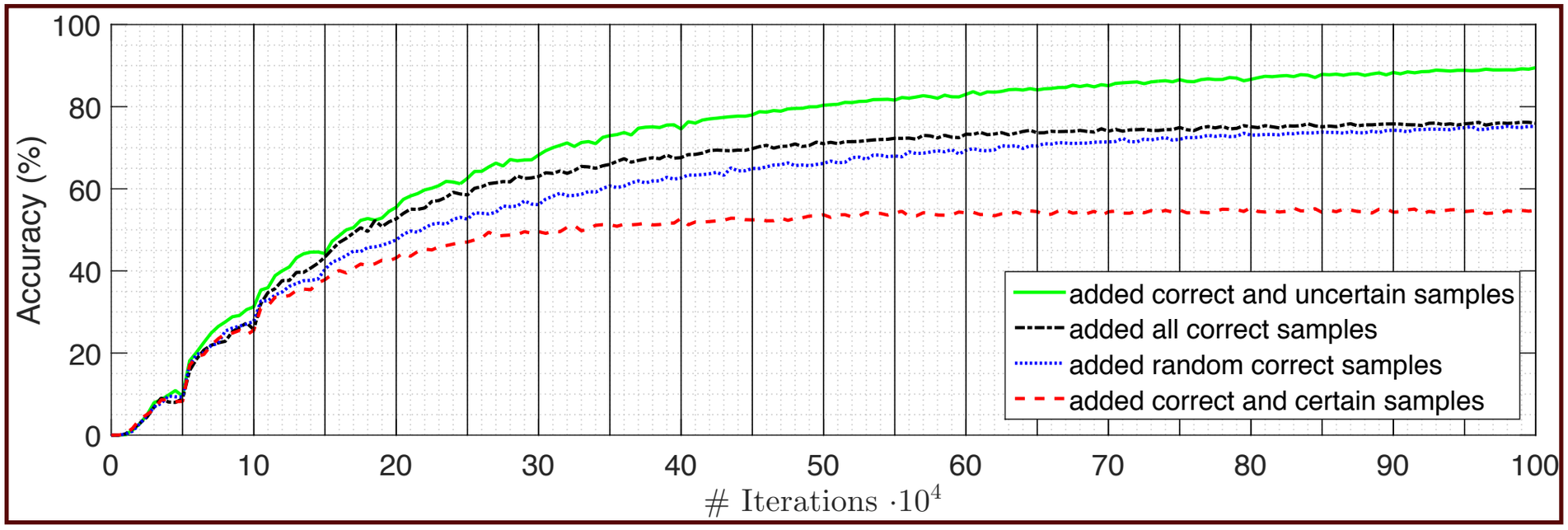
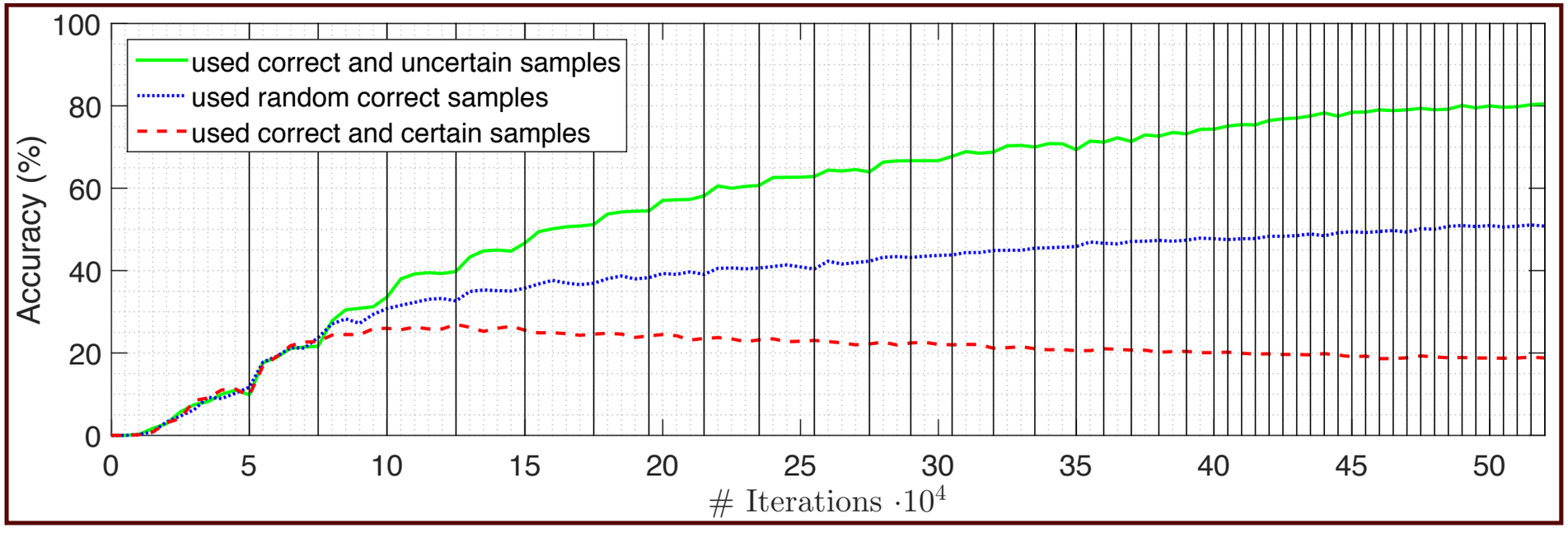


Fine-tuning on the new set



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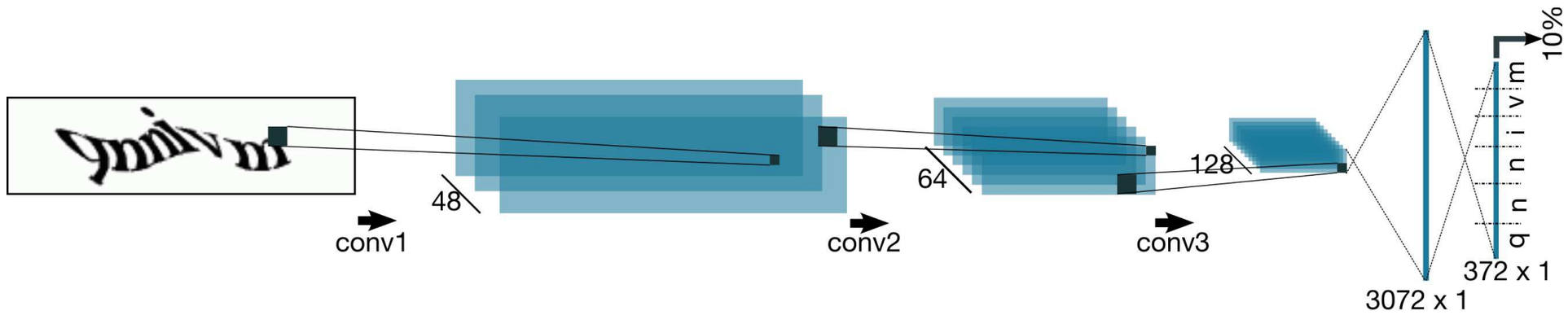

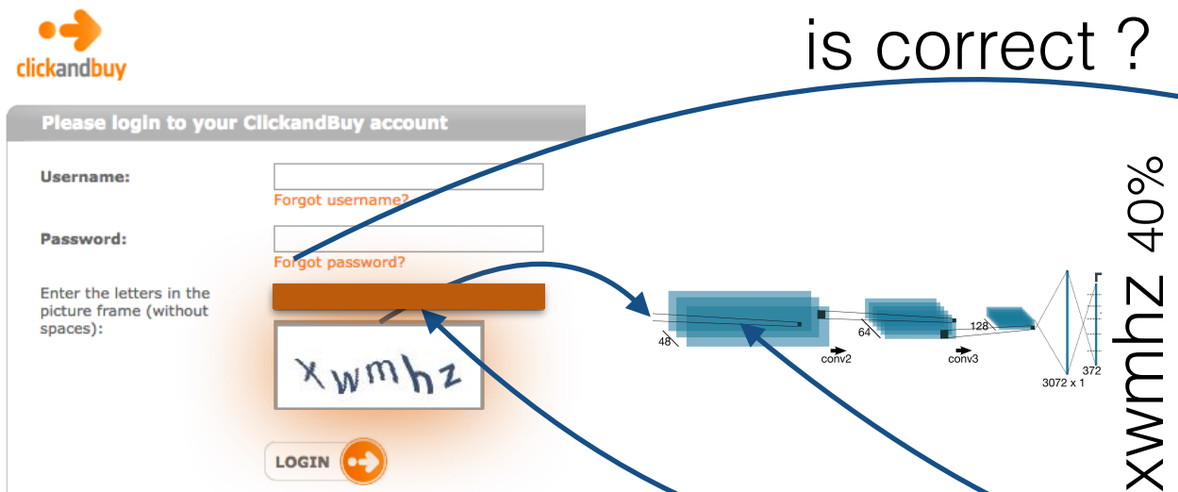

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