Empirical Learning

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"Let us see what is out there.."

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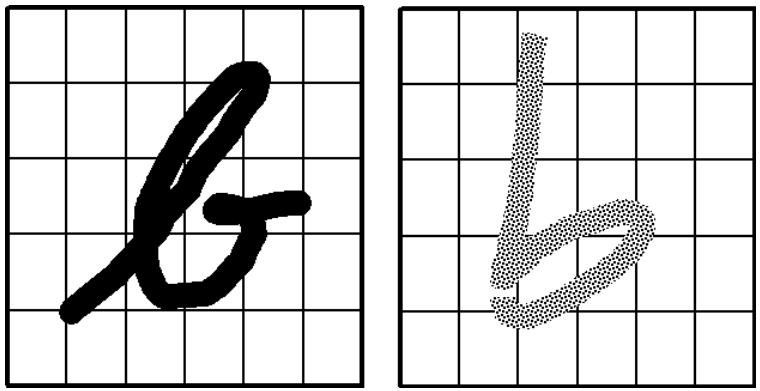

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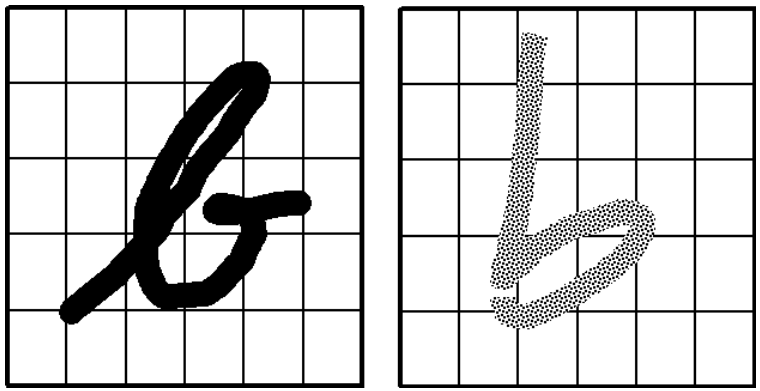

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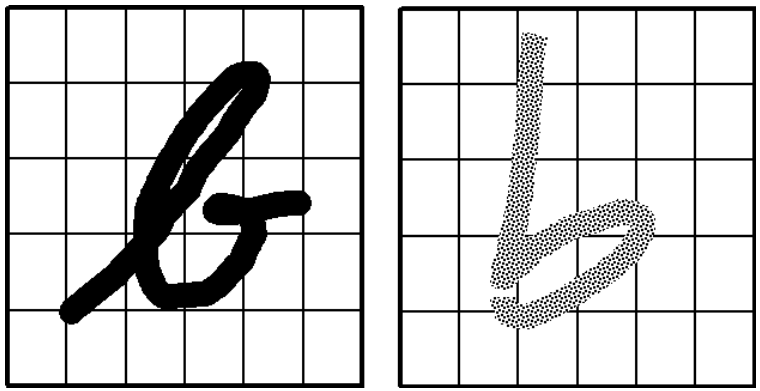

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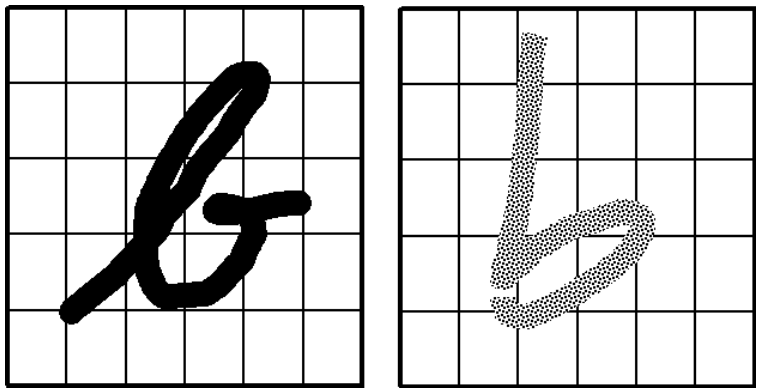

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- *Empirical model construction* becomes very attractive

Empirical Learning – A Typical Setting

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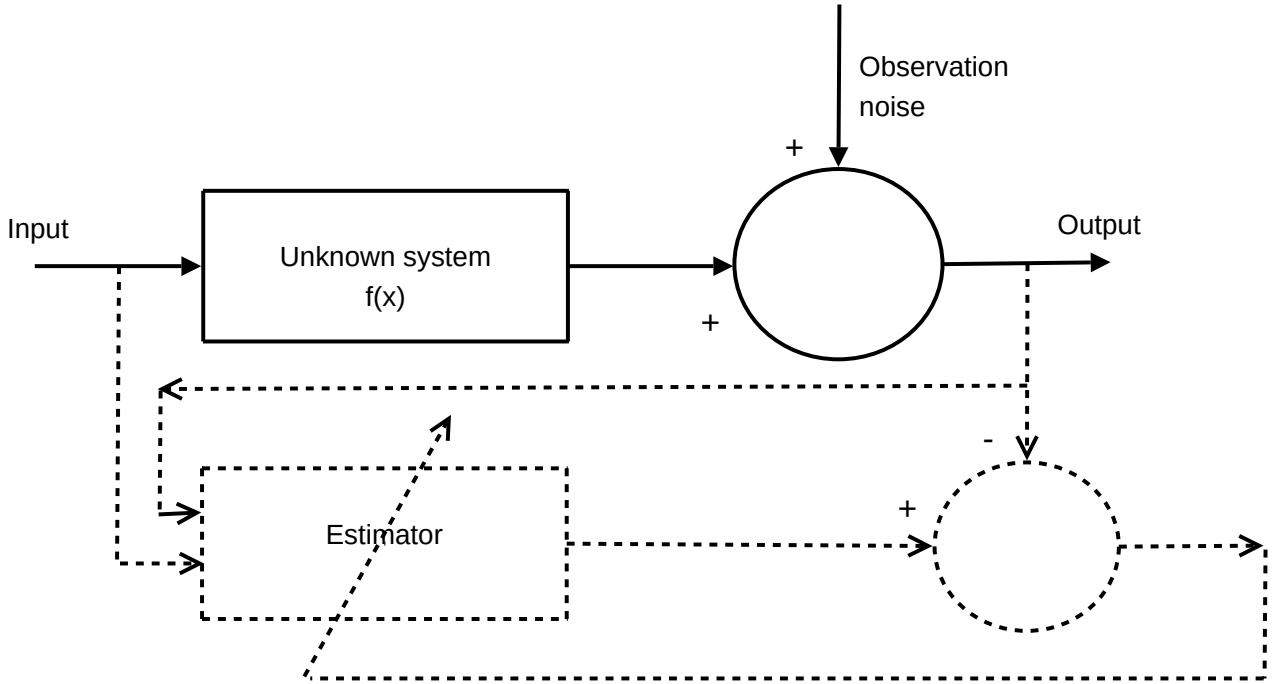

Observed Data

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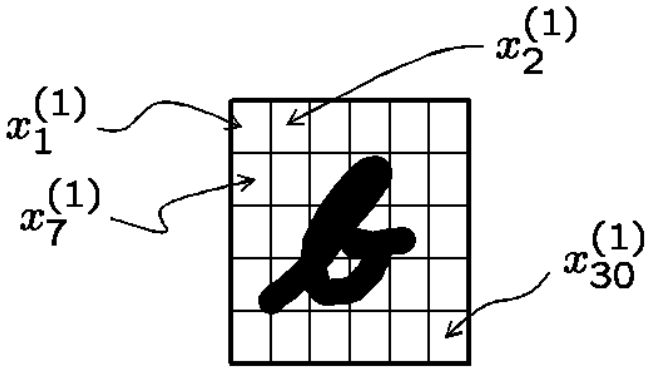

$$\mathbf{x}^{(1)} = [x_1^{(1)}\ x_1^{(1)}\ \ldots\ x_n^{(1)}]$$

0	0	…	1	0	$\mathbf{x}^{(1)}$ A character from John's writing
0	1	…	1	1	$\mathbf{x}^{(2)}$ A character from Mahesh's writing
		⋮			
1	1	…	0	0	$\mathbf{x}^{(N)}$ Another character from John's writing

Often called the input or the feature vector

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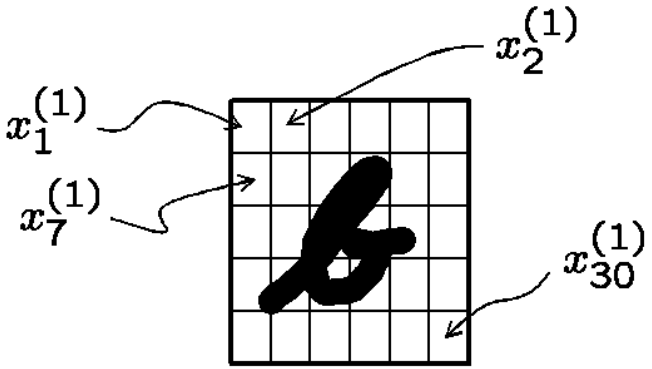

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- Observed data may be binary, real, categorical, ordered (and noisy!)

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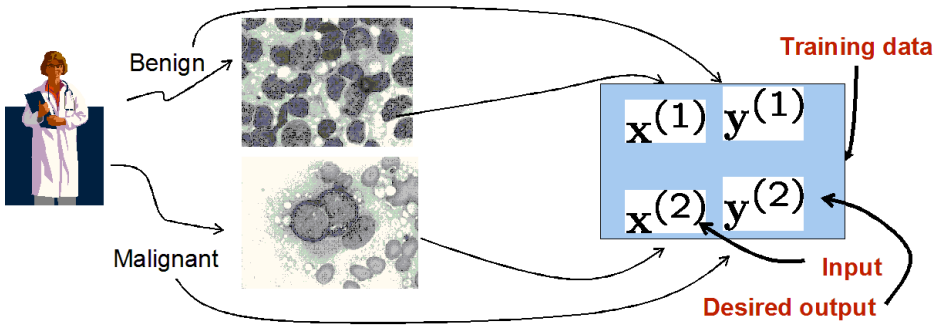

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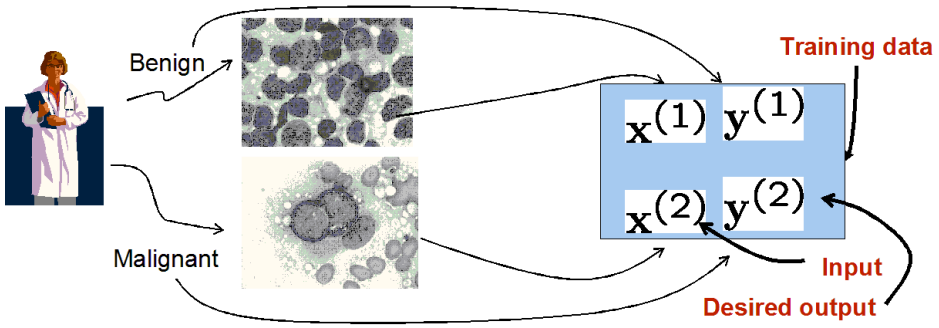

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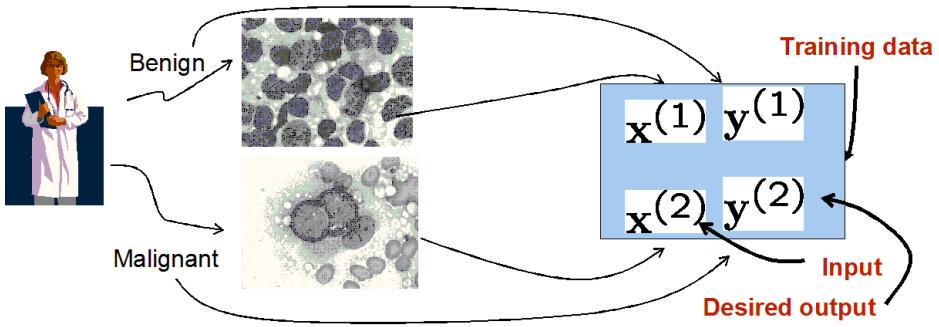

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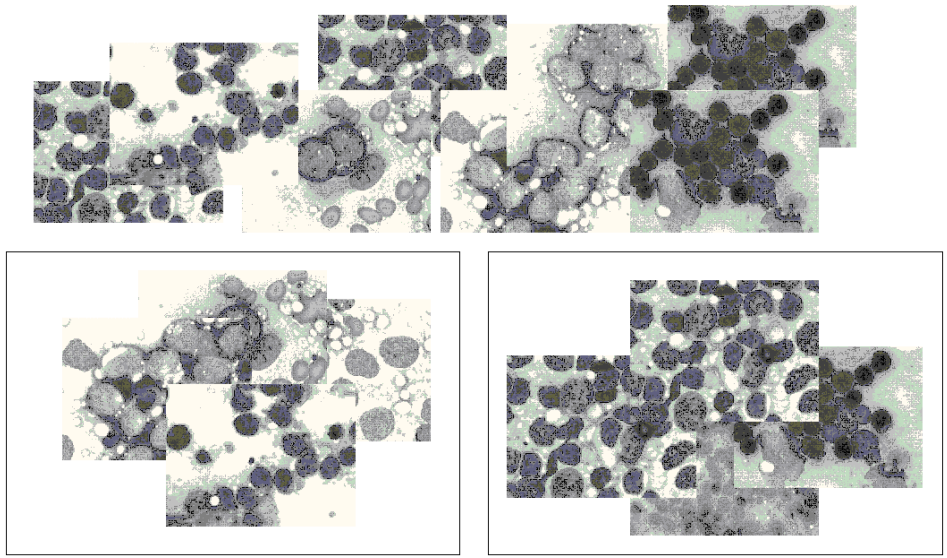

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Learning – A Formal Definition

Based on N (possibly noisy) observations $\mathcal{X} = \{(x^{(i)}, y^{(i)})\}_{i=1}^{N}$ *of the input and output of a fixed though unknown system* $f(x)$*, construct an estimator* $\hat{f}(x;\theta)$ *so as to minimize,*

$$E\left[\left(L(f(x) - \hat{f}(x;\theta))\right)\right]$$

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- How do we estimate the prediction error or validate the model?