Multi-category Generalization: Multi-class Perceptron (DHS 5.12)

Decision Rule:

$g_i(\underline{x})=\underline{w}^{(i)T}\underline{x}$
if $g_i(\underline{x})> g_j(\underline{x})$ for all $j\neq i$, assign $\underline{x}$ to S_i

Algorithm (given in class):
For each prototype $\underline{y}^{(i)}$

If $\underline{y}^{(i)} \in S_i$ but machine assigns it to S_j
Update for S_i, $w^{(i)}(k+1)=\underline{w}^{(i)}(k)+\alpha y^{(i)}$

Update for S_j, $w^{(j)}(k+1)=\underline{w}^{(j)}(k)-\alpha y^{(i)}$

$w^{(l)}(k+1)=\underline{w}^{(l)}(k)$ all $l\neq i,j$ (DHS p. 267, Eq. (115))

If machine classifies $\underline{y}^{(i)}$ correctly, do not update the prototype.

The algorithm is guaranteed to converge (for a fixed increment).

So far,
Error correcting method - Perceptron

- Update only for misclassified samples or prototypes
- Search for error-free solutions
- Samples must be linearly separable.