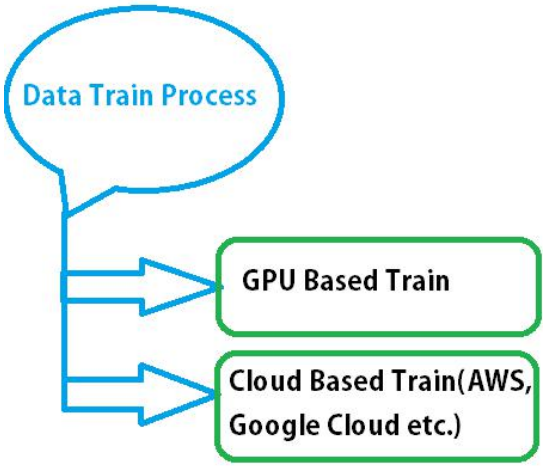
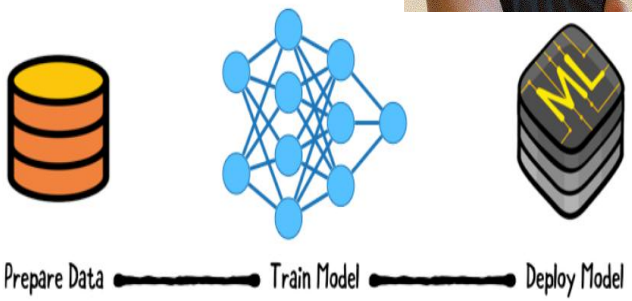
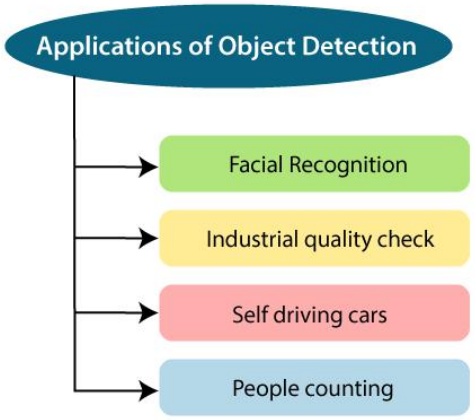
On Device Object Train and Recognition

Md Salah Uddin
PhD Researcher
Institute of Software Technology,
Technical University of Graz

Problem

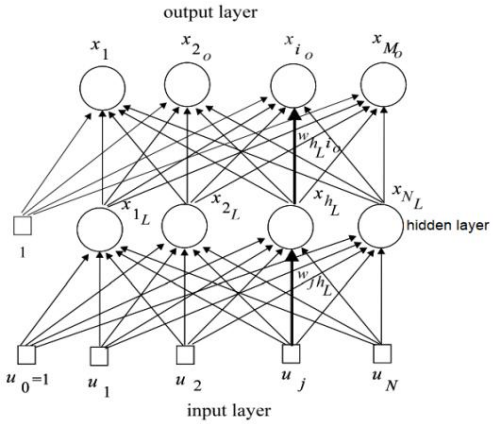






On Device Train

Solution



Neural Network Architecture

Step 0. Initialize weights: to small random values;

Step 1. Apply a sample: apply to the input a sample vector $\mathbf{u}^k$ having desired output vector $\mathbf{y}^k$;

Step 2. Forward Phase:

Starting from the first hidden layer and propagating towards the output layer:

Calculate the activation values for the units at layer L as:

If L-1 is the input layer

$$a_{h_L}^k = \sum_{j=0}^{N} w_{jh_L} u_j^k$$

If L-1 is a hidden layer

$$a_{h_L}^k = \sum_{j_{L-1}=0}^{N_{L-1}} w_{j_{(L-1)}h_L} x_{j_{(L-1)}}^k$$

Calculate the output values for the units at layer L as:

$$x_{h_L}^k = f_L(a_{h_L}^k)$$

in which use i_o instead of h_L if it is an output layer

Step 4. Output errors: Calculate the error terms at the output layer as:

$$\delta_{i_o}^k = (y_{i_o}^k - x_{i_o}^k) f_o'(a_{i_o}^k)$$

Step 5. Backward Phase Propagate error backward to the input layer through each layer L using the error term

$$\delta_{h_L}^k = f_L'(a_{h_L}^k) \sum_{i_{L+1}=1}^{N_{L+1}} \delta_{i_{(L+1)}}^k w_{h_L i_{(L+1)}}^k$$

in which, use i_o instead of $i_{(L+1)}$ if L+1 is an output layer;

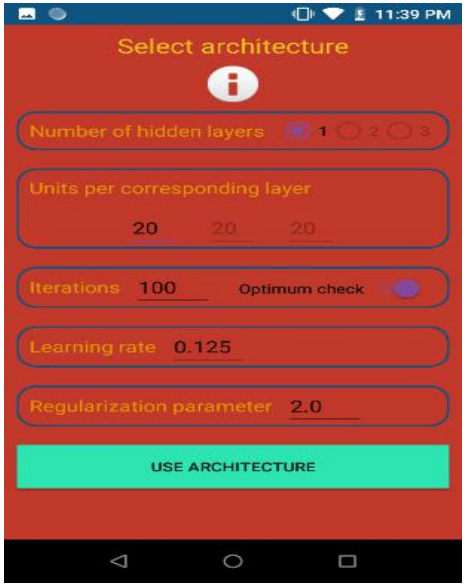
Step 6. Weight update: Update weights according to the formula

$$w_{j_{(L-1)}h_L}(t+1) = w_{j_{(L-1)}h_L}(t) + \eta \delta_{h_L}^k x_{j_{(L-1)}}^k$$

Step7. Repeat steps 1-6 until the stop criterion is satisfied, which may be chosen as the mean of the total error

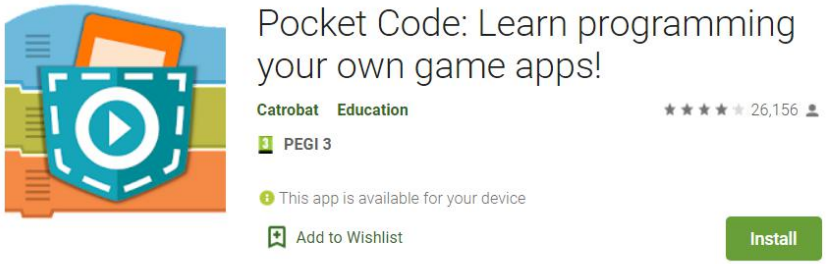
$$< e^k > = < \tfrac{1}{2} \sum_{i_o=1}^{M} (y_{i_o}^k - x_{i_o}^k)^2 >$$

Neural Network Algorithm



Developed Application

Product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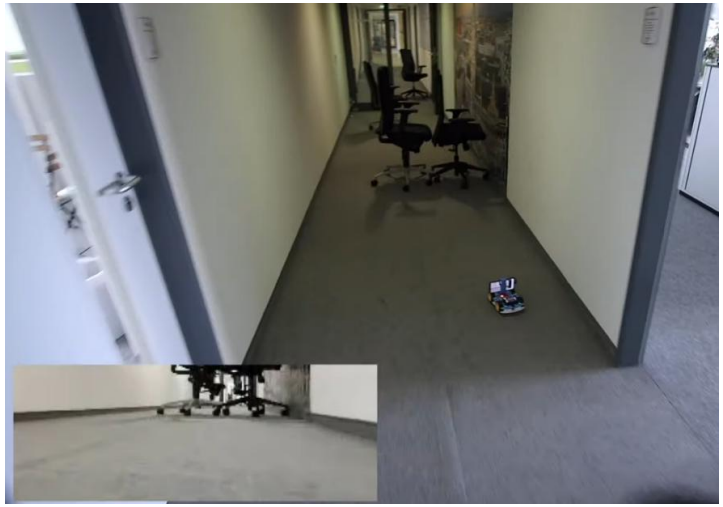

Market


11
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Team

Project Head and Founder

Herr	**Slany**, Wolfgang, Univ.-Prof. Dipl.-Ing. Dr.techn.
E-Mail	wolfgang.slany(at)tugraz.at
Homepage	http://www.ist.tugraz.at/wolfgang_slany.html
Telefon TU Graz	+43 316 873 - **5721**
Fax TU Graz	+43 316 873 - **105721**
Fax	+43 (316) 873 - 5706
Sprechstunde	Please arrange by email.
Postadresse	7160 Institut für Softwaretechnologie 8010 Graz, Inffeldgasse 16b/II
Dienstort	[7160] 8010 Graz, Inffeldgasse 16b/II, Raum IC02086
Lehrbefugnis	im Fach Softwaretechnologie