```
% STP_FN_APPROX_Script - Demonstates linear approximation for a one dimensional step
function.
%
% Note: the approximation is done by learning the coefficients of a "patches"
representation of
% the function.  Specifically, we assume that we have patch functions \phi_s(i) where
%
% \phi_s(i) = \left\{
%                       1 if s is in the ith patch
%                       0 otherwise
%             \right.
%
% And f(x) \appax f_n(x) = \sum_{n=1}^n w_i \phi_s(i)
%
% Written by:
% --
% John L. Weatherwax                2008-02-19
%
% email: wax@alum.mit.edu
%
% Please send comments and especially bug reports to the
% above email address.
%
%-----

close all;

alpha = 0.2; % our learning rate
n     = 100; % the number of patches

% the number of training samples/examples to generate/use:
nTrainingAll = [ 10, 40, 160, 640, 2560, 10240 ];
% the number of patches considered to be a unit:
widthAll     = [ 3, 9, 27 ];

rand('seed',0);

figure; hold on;
for nti=1:length(nTrainingAll),
  nTraining = nTrainingAll(nti);
  for wi=1:length(widthAll),
    width = widthAll(wi);

    %--
    % run this parameter variation:
    %--
    w = zeros(n,1);
    for ti=1:nTraining,
      x = rand; % <- get a random draw in [0,1]
      target     = targetF(x);
      f          = linAppFn(x,w,width);
      alphaError = (alpha/width)*(target - f);
      % update all patches that have this x as a member:
      for pti=1:n,
        if( abs( x - pti/n ) <= width/(2*n) )
          w(pti) = w(pti) + alphaError;
        end
      end
    end
```

```
    % plot our approximation along with the exact solution:
    nS = 100; x = linspace(0,1,nS); yA = zeros(nS,1); yE = zeros(nS,1);
    for xi=1:nS,
      yA(xi) = linAppFn(x(xi),w,width);
      yE(xi) = targetF(x(xi));
    end
    [sij] = sub2ind( [length(widthAll), length(nTrainingAll)], wi, nti );
    subplot( length(nTrainingAll), length(widthAll), sij );
    plot( x, yA, '-r' ); hold on; plot( x, yE, '-g', 'LineWidth', 1 ); axis( [ 0, 1, 0,
1.5 ] );

  end
end

saveas(gcf,'stp_fn_approx','jpg');
```