

plotSimulationSubset

Search for available trainings or test dataset and plot dataset. Follow user input dialog to choose which dataset and decide which array elements to plot. Save created plot to file. Filename same as dataset with attached info.

Syntax

```
plotSimulationSubset()
```

Description

plotSimulationSubset() plot training or test dataset which are located in data/test or data/training. The function lists all datasets and the user must decide during user input dialog which dataset to plot and how many angles to visualize. It loads path from config.mat and scans for file automatically.

Examples

```
plotSimulationSubset()
```

Input Arguments

None

Output Arguments

None

Requirements

- Other m-files required: None
- Subfunctions: None
- MAT-files required: config.mat

See Also

- [generateSimulationDatasets](#)
- [sensorArraySimulation](#)
- [generateConfigMat](#)

Created on November 29, 2020 by Tobias Wulf. Copyright Tobias Wulf 2020.

```
function plotSimulationSubset()
    % scan for datasets and load needed configurations %%%%%%%%%%%%%%%
    %%%%%%%%%%%%%%%
    try
        disp('Plot simulation dataset ...');
        close all;
        % load path variables
        load('config.mat', 'PathVariables');
        % scan for datasets
        TrainingDatasets = dir(fullfile(PathVariables.trainingDataPath, ...
            'Training_*.mat'));
        TestDatasets = dir(fullfile(PathVariables.testDataPath, 'Test_*.mat'));
        allDatasets = [TrainingDatasets; TestDatasets];
        % check if files available
        if isempty(allDatasets)
            error('No training or test datasets found.');
```

```

catch ME
    rethrow(ME)
end

% display available datasets to user, decide which to plot %%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

% number of datasets
nDatasets = length(allDatasets);
fprintf('Found %d datasets:\n', nDatasets)
for i = 1:nDatasets
    fprintf('%s\t:\t(%d)\n', allDatasets(i).name, i)
end
% get numeric user input to indicate which dataset to plot
iDataset = input('Type number to choose dataset to plot to: ');

% load dataset and ask user which one and how many angles %%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
try
    ds = load(fullfile(allDatasets(iDataset).folder, ...
        allDatasets(iDataset).name));
    % check how many angles in dataset and let user decide how many to
    % render in plot
    fprintf('Detect %d x %d sensors in dataset ...\n', ...
        ds.Info.SensorArrayOptions.dimension, ...
        ds.Info.SensorArrayOptions.dimension);
    xIdx = input('Enter x indices in []: ');
    yIdx = input('Enter y indices in []: ');
    if length(xIdx) ~= length(yIdx)
        error('Indices must have the same length!')
    end
    fprintf('Detect %d angles in dataset ...\n', ...
        ds.Info.UseOptions.nAngles);
    nSubAngles = input('How many angles to you wish to plot: ');
    % indices for data to plot, get sample distance for even distance
    sampleDistance = length(downsample(ds.Data.angles, nSubAngles));
    % get subset of angles
    subAngles = downsample(ds.Data.angles, sampleDistance);
    nSubAngles = length(subAngles); % just ensure
    % get indices for subset data
    angleIdx = find(ismember(ds.Data.angles, subAngles));
catch ME
    rethrow(ME)
end

% figure save path for different formats %%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fPath = fullfile(PathVariables.saveFiguresPath);
fSvgPath = fullfile(PathVariables.saveImagesPath, 'svg');
fEpsPath = fullfile(PathVariables.saveImagesPath, 'eps');
fPdfPath = fullfile(PathVariables.saveImagesPath, 'pdf');

% create dataset figure for a subset or all angle %%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fig = figure('Name', 'Sensor Array', ...
    'NumberTitle', 'off', ...
    'WindowStyle', 'normal', ...
    'MenuBar', 'none', ...
    'ToolBar', 'none', ...
    'Units', 'centimeters', ...
    'OuterPosition', [0 0 37 29], ...
    'PaperType', 'a4', ...

```

```

    'PaperUnits', 'centimeters', ...
    'PaperOrientation', 'landscape', ...
    'PaperPositionMode', 'auto', ...
    'DoubleBuffer', 'on', ...
    'RendererMode', 'manual', ...
    'Renderer', 'painters');

tdl = tiledlayout(fig, 3, 4, ...
    'Padding', 'compact', ...
    'TileSpacing', 'compact');

title(tdl, 'Sensor Array Simulation', ...
    'FontWeight', 'normal', ...
    'FontSize', 18, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

subline1 = "Sensor Array (%s) of %d\times%d$ sensors," + ...
    " an edge length of %.1f$ mm, a rel. pos. to magnet surface of";
subline2 = " $(%.1f, %.1f, -(%1f))$ in mm, a magnet tilt" + ...
    " of %.1f^\circ$, a sphere radius of %.1f$ mm, a imprinted";
subline3 = "field strength of %.1f$ kA/m at %.1f$ mm from" + ...
    " sphere surface in z-axis, %d$ rotation angles with a ";
subline4 = "step width of %.1f^\circ$ and a resolution" + ...
    " of %.1f^\circ$. Visualized is a subset of %d$ angles in ";
subline5 = "sample distance of %d$ angles. Based on %s" + ...
    " characterization reference %s.";
sub = [sprintf(subline1, ...
    ds.Info.SensorArrayOptions.geometry, ...
    ds.Info.SensorArrayOptions.dimension, ...
    ds.Info.SensorArrayOptions.dimension, ...
    ds.Info.SensorArrayOptions.edge); ...
    sprintf(subline2, ...
    ds.Info.UseOptions.xPos, ...
    ds.Info.UseOptions.yPos, ...
    ds.Info.UseOptions.zPos, ...
    ds.Info.UseOptions.tilt, ...
    ds.Info.DipoleOptions.sphereRadius); ...
    sprintf(subline3, ...
    ds.Info.DipoleOptions.H0mag, ...
    ds.Info.DipoleOptions.z0, ...
    ds.Info.UseOptions.nAngles); ...
    sprintf(subline4, ...
    ds.Data.angleStep, ...
    ds.Info.UseOptions.angleRes, ...
    nSubAngles)
    sprintf(subline5, ...
    sampleDistance, ...
    ds.Info.CharData, ...
    ds.Info.UseOptions.BridgeReference)];

subtitle(tdl, sub, ...
    'FontWeight', 'normal', ...
    'FontSize', 14, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

% get subset of needed data to plot, only one load %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
N = ds.Info.SensorArrayOptions.dimension;
X = ds.Data.X;

```

```

Y = ds.Data.Y;
Z = ds.Data.Z;

% calc limits of plot 1
maxX = ds.Info.UseOptions.xPos + ds.Info.SensorArrayOptions.edge;
maxY = ds.Info.UseOptions.yPos + ds.Info.SensorArrayOptions.edge;
minX = ds.Info.UseOptions.xPos - ds.Info.SensorArrayOptions.edge;
minY = ds.Info.UseOptions.yPos - ds.Info.SensorArrayOptions.edge;

% calculate colormap to identify scatter points
c=zeros(N,N,3);
for i = 1:N
    for j = 1:N
        c(i,j,:) = [(2*N+1-2*i), (2*N+1-2*j), (i+j)]/2/N;
    end
end
c = squeeze(reshape(c, N^2, 1, 3));
% reshape RGB for picking single sensors
R = reshape(c(:,1), N, N);
G = reshape(c(:,2), N, N);
B = reshape(c(:,3), N, N);

% load offset voltage to subtract from cosinus, sinus voltage
Voff = ds.Info.SensorArrayOptions.Voff;
Vcc = ds.Info.SensorArrayOptions.Vcc;

% plot sensor grid in x and y coordinates and constant z layer %%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
ax1 = nexttile(1);
% plot each cooredinate in loop to create a special shading constant
% reliable to orientation for all matrice
hold on;

scatter(X(:), Y(:), [], [0.8 0.8 0.8], 'filled', ...
    'MarkerEdgeColor', 'k', 'LineWidth', 0.8);

for k = 1:length(xIdx)
    i = xIdx(k); j = yIdx(k);
    scatter(X(i,j), Y(i,j), [], [R(i,j), G(i,j), B(i,j)], 'filled', ...
        'MarkerEdgeColor', 'k', 'LineWidth', 0.8);
end

% axis shape and ticks
axis square xy;
axis tight;
grid on;
xlim([minX maxX]);
ylim([minY maxY]);

% text and labels
text(minX+0.2, minY+0.2, ...
    sprintf('$Z = %.1f$ mm', Z(1)), ...
    'Color', 'k', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

xlabel('$X$ in mm', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

```

```

ylabel('$Y$ in mm', ...
      'FontWeight', 'normal', ...
      'FontSize', 12, ...
      'FontName', 'Times', ...
      'Interpreter', 'latex');

title(sprintf('Sensor Array %d\\times%d$', N, N), ...
      'FontWeight', 'normal', ...
      'FontSize', 12, ...
      'FontName', 'Times', ...
      'Interpreter', 'latex');

hold off;

% plot rotation angles in polar view %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
nexttile(2);
% plot all angles grayed out
polarscatter(ds.Data.angles/180*pi, ones(1, ds.Info.UseOptions.nAngles), ...
            5, [0.8 0.8 0.8], 'filled');

% radius ticks and label
rticks(1);
rticklabels("");
hold on;

% plot subset of angles
polarscatter(subAngles/180*pi, ones(1, nSubAngles), 5, 'b', 'filled');
ax2 = gca;

% axis shape
axis tight;

% text an labels
title('Rotation around Z-Axis in Degree', ...
      'FontWeight', 'normal', ...
      'FontSize', 12, ...
      'FontName', 'Times', ...
      'Interpreter', 'latex');

hold off;

% Cosinus bridge outputs for rotation step %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
ax3 = nexttile(3);
hold on;

% set colormap
colormap('gray');

% plot cosinus reference, set NaN values to white color, orient Y to normal
imC = imagesc(ds.Data.HxScale, ds.Data.HyScale, ds.Data.VcosRef);
set(imC, 'AlphaData', ~isnan(ds.Data.VcosRef));
set(gca, 'YDir', 'normal')

% axis shape and ticks
axis square xy;
axis tight;
yticks(xticks);
grid on;

```

```

% test and labels
xlabel('$H_x$ in kA/m', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

ylabel('$H_y$ in kA/m', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

title('$V_{\cos}(H_x, H_y)$', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

hold off;

% Sinus bridge outputs for rotation step %%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
ax4 = nexttile(4);
hold on;

% set colormap
colormap('gray');

% plot sinus reference, set NaN values to white color, orient Y to normal
imS = imagesc(ds.Data.HxScale, ds.Data.HyScale, ds.Data.VsinRef);
set(imS, 'AlphaData', ~isnan(ds.Data.VsinRef));
set(gca, 'YDir', 'normal')

% axis shape and ticks
axis square xy;
axis tight;
yticks(xticks);
grid on;

% test and labels
xlabel('$H_x$ in kA/m', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

ylabel('$H_y$ in kA/m', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

title('$V_{\sin}(H_x, H_y)$', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

% add colorbar and place it
cb2 = colorbar;
cb2.Label.String = 'in V';

```

```

cb2.Label.Interpreter = 'latex';
cb2.Label.FontSize = 12;

hold off;

% plot Vcos Vsin over angles %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% axes limits
xlimits = [-10 370];
ylimits = [min(cat(...
    3, ds.Data.VsinRef, ds.Data.VcosRef), [], 'all') - 0.1*Vcc, ...
    max(cat(3, ds.Data.VsinRef, ds.Data.VcosRef), [], 'all') + 0.1*Vcc];

% Vcos
ax5 = nexttile([1 4]);
yline(Voff, 'k-.', 'LineWidth', 1.2);
xlim(xlimits);
ylim(ylimits);
grid on;

xlabel('$\theta$ in Degree', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

ylabel('$V_{\cos}(\theta)$ in V', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

title(sprintf(...
    "$V_{\cos}$ of Enabled Array Positions over $\theta$, " + ...
    " $V_{cc} = %.1f$ V, $V_{off} = %.2f$ V", Vcc, Voff), ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

% Vsin
ax6 = nexttile([1 4]);
yline(Voff, 'k-.', 'LineWidth', 1.2);
xlim(xlimits);
ylim(ylimits);
grid on;

xlabel('$\theta$ in Degree', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

ylabel('$V_{\sin}(\theta)$ in V', ...
    'FontWeight', 'normal', ...
    'FontSize', 12, ...
    'FontName', 'Times', ...
    'Interpreter', 'latex');

title(sprintf("$V_{\sin}$ of Enabled Array Positions over " + ...
    " $\theta$, $V_{cc} = %.1f$ V, $V_{off} = %.2f$ V", Vcc, Voff), ...
    'FontWeight', 'normal', ...

```

```

        'FontSize', 12, ...
        'FontName', 'Times', ...
        'Interpreter', 'latex');

% loop through subset of dataset and renew plots %%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% lock plots
hold(ax3, 'on');
hold(ax4, 'on');
hold(ax5, 'on');
hold(ax6, 'on');

% loop over indices
for k = 1:length(xIdx)
    i = xIdx(k); j = yIdx(k);
    % H load subset
    Hx = squeeze(ds.Data.Hx(i,j,angleIdx));
    Hy = squeeze(ds.Data.Hy(i,j,angleIdx));
    % get min max

    % load V subset
    Vcos = squeeze(ds.Data.Vcos(i,j,angleIdx));
    Vsin = squeeze(ds.Data.Vsin(i,j,angleIdx));

    % update plot 3, 4, 5 and 6
    scatter(ax3, Hx, Hy, 1, [R(i,j), G(i,j), B(i,j)] , 'filled');
    scatter(ax4, Hx, Hy, 1, [R(i,j), G(i,j), B(i,j)] , 'filled');
    scatter(ax5, subAngles, Vcos, 12, [R(i,j), G(i,j), B(i,j)] , ...
        'filled', 'MarkerEdgeColor', 'k', 'LineWidth', 0.5);
    scatter(ax6, subAngles, Vsin, 12, [R(i,j), G(i,j), B(i,j)] , ...
        'filled', 'MarkerEdgeColor', 'k', 'LineWidth', 0.5);
end

% release plots
hold(ax3, 'off');
hold(ax4, 'off');
hold(ax5, 'off');
hold(ax6, 'off');

% save figure to file %%%%%%%%%%%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% get file path to save figure with angle index
 [~, fName, ~] = fileparts(ds.Info.filePath);

% save to various formats
yesno = input('Save? [y/n]: ', 's');
if strcmp(yesno, 'y')
    fLabel = input('Enter file label: ', 's');
    fName = fName + "_SubsetPlot_" + fLabel;
    savefig(fig, fullfile(fPath, fName));
    print(fig, fullfile(fSvgPath, fName), '-dsvg');
    print(fig, fullfile(fEpsPath, fName), '-depsc', '-tiff', '-loose');
    print(fig, fullfile(fPdfPath, fName), '-dpdf', '-loose', '-fillpage');
end
close(fig);
end

```