Wavelet Reminder Sheet

- **One Dimensional:** Suppose we have two signals $y_1$ and $y_2$ and we want to perform a level 3 Haar decomposition. Here is the syntax:

  ```
  n = 3;
  fam = 'db1';
  [C1,L1] = wavedec(y1,n,fam);
  [C2,L2] = wavedec(y2,n,fam);
  ```

  - To extract the level one details:
    ```
    y1d1 = wrcoef('d',C1,L1,fam,1);
    y2d1 = wrcoef('d',C2,L2,fam,1);
    ```
  
  - To extract the level one approximations:
    ```
    y1a1 = wrcoef('a',C1,L1,fam,1);
    y2a1 = wrcoef('a',C2,L2,fam,1);
    ```

  - To extract the level two details:
    ```
    y1d2 = wrcoef('d',C1,L1,fam,2);
    y2d2 = wrcoef('d',C2,L2,fam,2);
    ```

  - To extract the level two approximations:
    ```
    y1a2 = wrcoef('a',C1,L1,fam,2);
    y2a2 = wrcoef('a',C2,L2,fam,2);
    ```

  - You can then see how to get the level 3 details and approximations $y_{1d3}$, $y_{2d3}$, $y_{1a3}$, $y_{2a3}$.

  - To plot any one of these, for instance $y_{1d2}$, just enter `plot(y_{1d2})`.

- **Two Dimensional:** Suppose we have two images $y_1$ and $y_2$ and we want to perform a level 3 Haar decomposition. Here is the syntax:

  ```
  n = 3;
  fam = 'db1';
  [C1,S1] = wavedec2(y1,n,fam);
  [C2,S2] = wavedec2(y2,n,fam);
  ```

  - To extract the level one details and approximations of $y_1$ and $y_2$, respectively:
    ```
    * horizontal details:
      ```
      y1H1 = wrcoef2('h',C1,S1,fam,1);
      y2H1 = wrcoef2('h',C2,S2,fam,1);
      ```
    
    * vertical details:
      ```
      y1V1 = wrcoef2('v',C1,S1,fam,1);
      y2V1 = wrcoef2('v',C2,S2,fam,1);
      ```
* diagonal details:
  \[
  y_{1D1} = \text{wrcoef2}'d',C1,S1,fam,1);
  y_{2D1} = \text{wrcoef2}'d',C2,S2,fam,1);
\]
* approximations:
  \[
  y_{1A1} = \text{wrcoef2}'a',C1,S1,fam,1);
  y_{2A1} = \text{wrcoef2}'a',C2,S2,fam,1);
\]
- To extract the level two details and approximations of \( y_1 \) and \( y_2 \), respectively:
  * horizontal details:
    \[
    y_{1H2} = \text{wrcoef2}'h',C1,S1,fam,2);
    y_{2H2} = \text{wrcoef2}'h',C2,S2,fam,2);
\]
  * vertical details:
    \[
    y_{1V2} = \text{wrcoef2}'v',C1,S1,fam,2);
    y_{2V2} = \text{wrcoef2}'v',C2,S2,fam,2);
\]
  * diagonal details:
    \[
    y_{1D2} = \text{wrcoef2}'d',C1,S1,fam,2);
    y_{2D2} = \text{wrcoef2}'d',C2,S2,fam,2);
\]
  * approximations:
    \[
    y_{1A2} = \text{wrcoef2}'a',C1,S1,fam,2);
    y_{2A2} = \text{wrcoef2}'a',C2,S2,fam,2);
\]
- You can now see how to extract the level 3 details and approximations.
- To plot any one of these, first enter just one time:
  \[
  \text{map} = [1 1 1; 0 0 0];
\]
  Then for any detail or approximation you wish to plot, for instance \( y_{2V2} \), enter
  \[
  \text{image}(y_{2V2}); \text{colormap}(\text{map});
\]
  You do not need to enter \( \text{map} \) again.