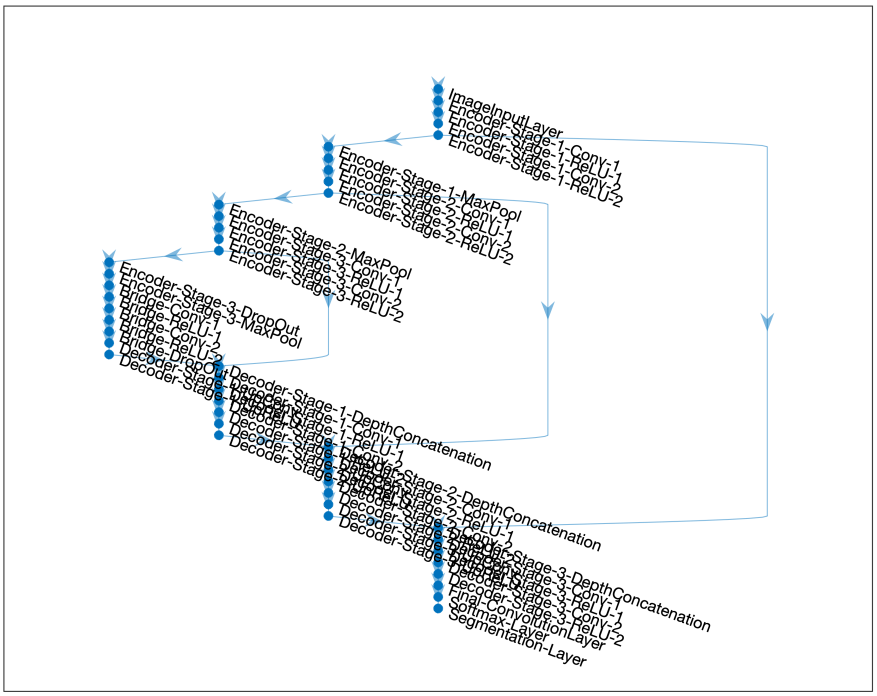
Segmentation U-Net

1) Create a U-Net network with an encoder-decoder depth of 3

```
clear all

%A = imread("IMG_3684.JPG")
imageSize = [480 640 3];
numClasses = 5;
Name = 'EncoderDepth';
Value = 3;

lgraph = unetLayers(imageSize,numClasses,Name,Value)
```

```
lgraph =
  LayerGraph with properties:

         Layers: [46×1 nnet.cnn.layer.Layer]
    Connections: [48×2 table]
     InputNames: {'ImageInputLayer'}
    OutputNames: {'Segmentation-Layer'}
```

```
plot(lgraph)
```



2) Train U-Net for semantic segmentation

```
dataSetDir = fullfile(toolboxdir('vision'),'visiondata','triangleImages');
```

```
imageDir = fullfile(dataSetDir,'trainingImages');
labelDir = fullfile(dataSetDir,'trainingLabels');

imds = imageDatastore(imageDir);

classNames = ["triangle","background"];
labelIDs   = [255 0];

% Create a pixelLabelDatastore object to store the ground truth pixel
% labels for the training images.
pxds = pixelLabelDatastore(labelDir,classNames,labelIDs);

%% Crating the U-Net network
imageSize2 = [32 32];
numClasses2 = 2;
lgraph2 = unetLayers(imageSize2, numClasses2)
```

```
lgraph2 =
  LayerGraph with properties:

         Layers: [58×1 nnet.cnn.layer.Layer]
    Connections: [61×2 table]
     InputNames: {'ImageInputLayer'}
    OutputNames: {'Segmentation-Layer'}
```

```
ds = combine(imds,pxds); % Datastore for training the network.

%% Training options
options = trainingOptions('sgdm', ...
    'InitialLearnRate',1e-3, ...
    'MaxEpochs',20, ...
    'VerboseFrequency',10);

%% Train the network
net = trainNetwork(ds,lgraph2,options)
```

```
Training on single CPU.
Initializing input data normalization.
|========================================================================================|
|  Epoch  |  Iteration  |  Time Elapsed  |  Mini-batch  |  Mini-batch  |  Base Learning  |
|         |             |   (hh:mm:ss)   |   Accuracy   |     Loss     |      Rate       |
|========================================================================================|
|       1 |           1 |       00:00:14 |       42.16% |       5.7818 |          0.0010 |
|      10 |          10 |       00:02:04 |       95.13% |       0.4988 |          0.0010 |
|      20 |          20 |       00:04:25 |       96.69% |       0.2265 |          0.0010 |
|========================================================================================|
net =
  DAGNetwork with properties:

         Layers: [58×1 nnet.cnn.layer.Layer]
    Connections: [61×2 table]
     InputNames: {'ImageInputLayer'}
    OutputNames: {'Segmentation-Layer'}
```

What is the most appropriate number of max epochs you can use? Why?

R: El número de epochs más apropiado es 20 ya que se tiene una precisión mayor, siendo esta de 96.69% y se pierde menos infromación (0.2265).

How did the learning rate affect the accuracy?

R: Mientras más pequeño sea el learning rate, la precisión disminuye.