ML_RS

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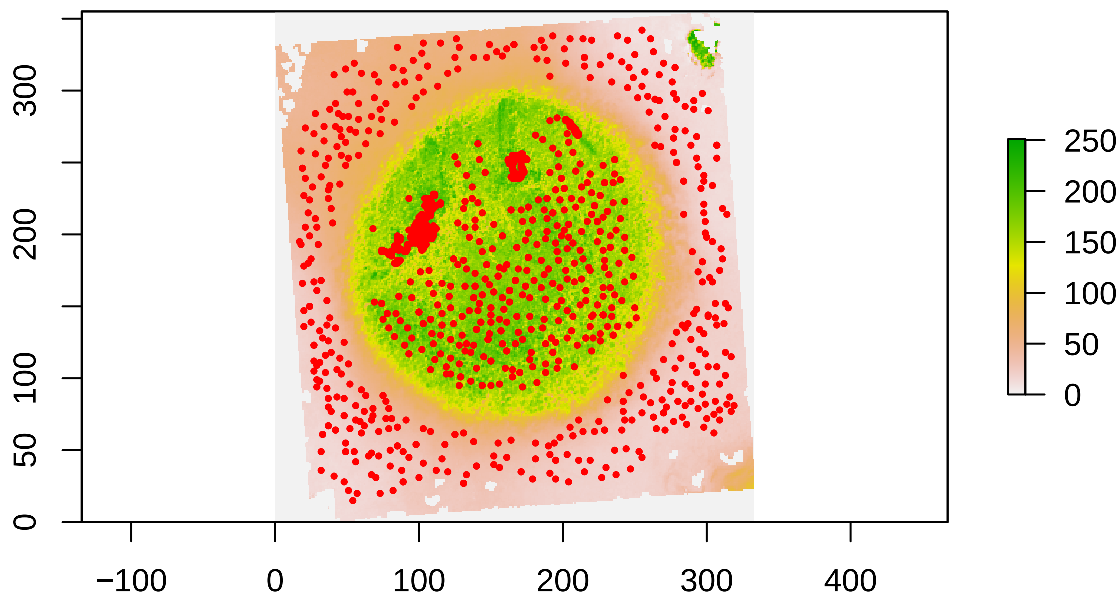
Import raster

Import raster information and sampled points (using ArcGIS Pro).

```
imp.reef <- raster::brick("D:/HIMB/MBIO630/Data/Reef_20_2022_01_18_20cm_pix.tif")
imp.reef.sb <- raster("D:/HIMB/MBIO630/Data/Reef_20_2022_01_18_20cm_pix.tif")
sampled.points <- read.csv("D:/HIMB/MBIO630/Data/TrainingSet/TrainingSet.csv")
plot(imp.reef.sb)
points(sampled.points$Long, sampled.points$Lat, col = "red", pch = 16, cex = 0.5)
```



Extract RGB information

```r
extracted.RGB <- raster::extract(imp.reef, sampled.points[, c("Long", "Lat")])
extracted.RGB <- as.data.frame(extracted.RGB)
my.dataset <- cbind(extracted.RGB[, (1:3)], sampled.points$CLASS)
colnames(my.dataset) <- c("R", "G", "B", "CLASS")
```

Building training and test set

```r
sample.values <- sample(1:nrow(my.dataset), 750)
training.set <- my.dataset[sample.values, ]
test.set <- my.dataset[-sample.values, ]
```

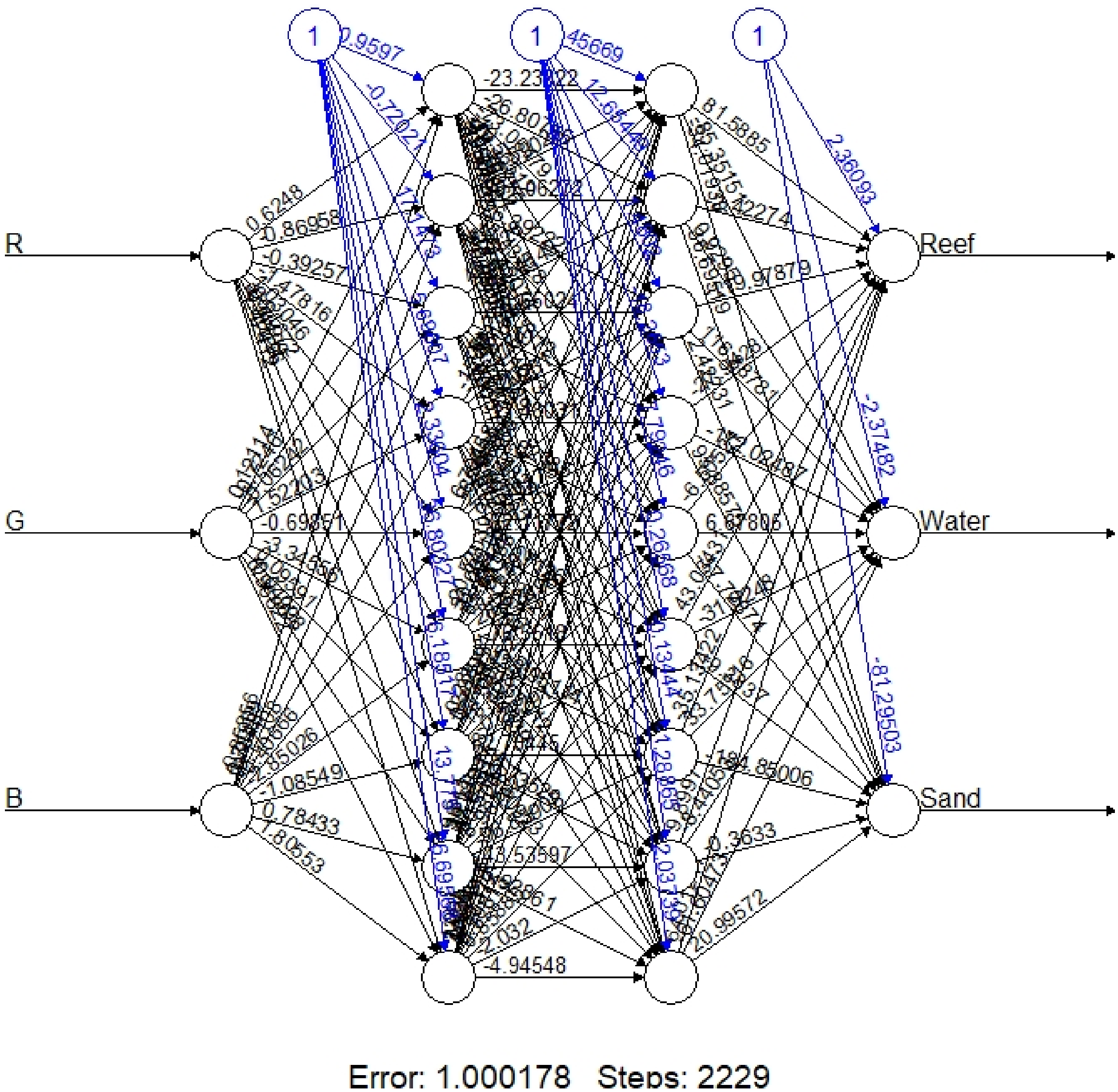
Multilayer Perceptron

Model has been trained and saved for time reasons. But you can try to play with different configurations of the model :).

```r
nn.model <- neuralnet(CLASS ~ R + G + B, lifesign = "minimal",
             data = training.set, hidden = c(9, 9), linear.output = FALSE,
             rep = 1, stepmax = 1000000,
             threshold = 0.01)
```

```
## hidden: 9, 9    thresh: 0.01    rep: 1/1    steps:   44616   error: 1.00014  time: 46.26 secs
```

```r
plot(nn.model)
```



Testing Predict class values for the test set.

```
class.prediction <- predict(nn.model, test.set[, c(1:3)])
idx <- apply(class.prediction, 1, which.max)
predicted <- c('Reef', 'Sand', 'Water')[idx] #alphabetical order
```

Lets see the confusion matrix (i.e., Predicted vs Observed)

```
cm <- table(predicted, test.set$CLASS)
cm
```

```
##
## predicted Reef Sand Water
##      Reef  127    1     0
```

```
##     Sand      2    64      0
##     Water     0     0    148
```

WOW! That's a good model!

```
res.k <- Kappa(cm)
res.k
```

```
##              value      ASE     z Pr(>|z|)
## Unweighted 0.9862 0.007927 124.4        0
## Weighted   0.9909 0.005255 188.5        0
```

Even the Cohen's Kappa value confirms it.

MLP prediction on raster image

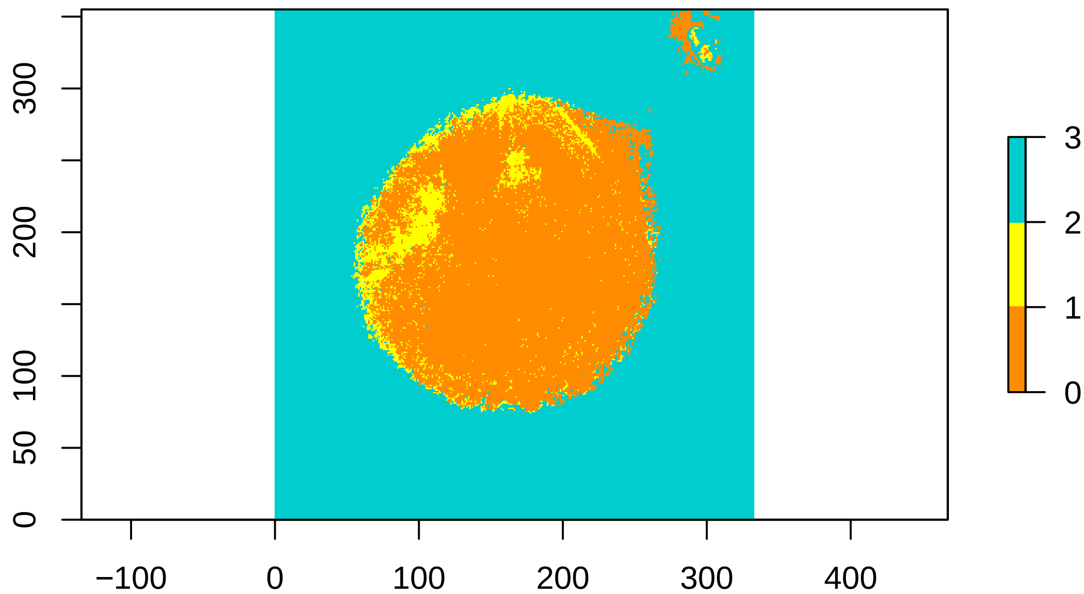
Create dataframe of RGB values from raster.

```
all.rgb <- as.data.frame(matrix(nrow = length(imp.reef.sb), ncol = 3))
colnames(all.rgb) <- c('R', 'G', 'B')
all.rgb$R <- imp.reef$Reef_20_2022_01_18_20cm_pix.1[1:length(imp.reef.sb)]
all.rgb$G <- imp.reef$Reef_20_2022_01_18_20cm_pix.2[1:length(imp.reef.sb)]
all.rgb$B <- imp.reef$Reef_20_2022_01_18_20cm_pix.3[1:length(imp.reef.sb)]
```

And now predict classes for the entire reef.

```
class.prediction.all <- predict(nn.model, all.rgb)
idx.all <- apply(class.prediction.all, 1, which.max)
predicted.all <- c('Reef', 'Sand', 'Water')[idx.all]
pred.reef <- imp.reef
pred.reef$Reef_20_2022_01_18_20cm_pix.4 <- idx.all
myColor <- c("darkorange", "yellow", "cyan3")

plot(pred.reef$Reef_20_2022_01_18_20cm_pix.4, breaks=c(0, 1, 2, 3),
     col = myColor)
```



300
200
100
50
0
−100
0
100
200
300
400
3
2
1
0