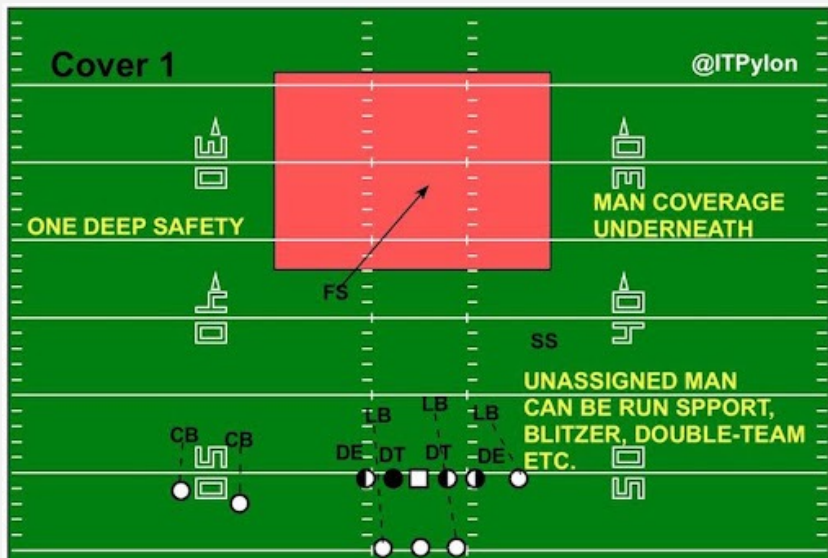


CLASSIFYING DEFENSIVE COVERAGES WITH NEURAL NETWORKS

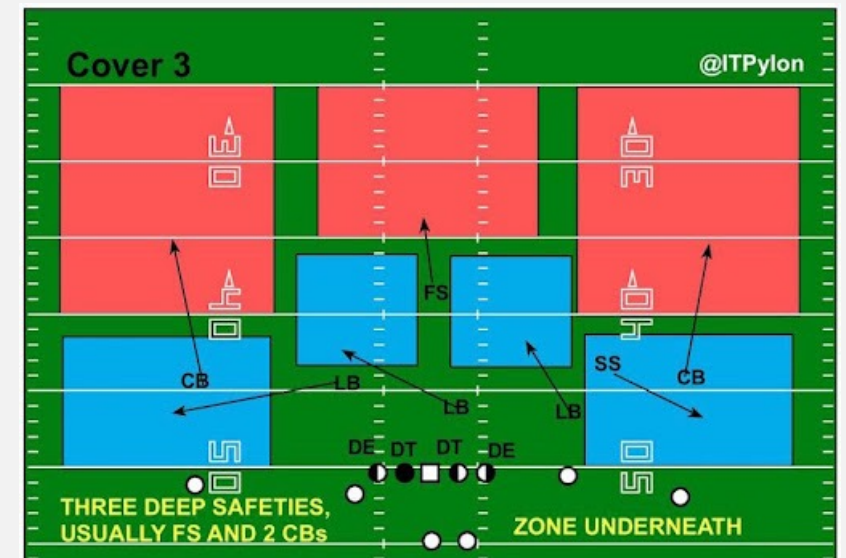
Spencer Kerch

BACKGROUND

- There are 7 basic classifiers of defensive coverages in American football
 - Cover 0 Man, Cover 1 Man, Cover 2 Man, Cover 2 Zone, Cover 3 Zone, Cover 4 Zone, Cover 6 Zone and Prevent Zone
- Coverages are often disguised and difficult to classify, especially pre-snap
- Accurate labeling requires watching every play



Cover 1 Man vs Cover 3 Zone



DATA

- Tracking data & coverage labels of every passing play from week 1 of the 2018 NFL season
 - Data from the 2021 Big Data Bowl
- Transformed into a tensor with size $985 \times 12 \times 11 \times 5$
 - Number of plays x features x possible defenders x offensive players (No QB)
- Features: `dist_from_los`, `y`, `s_x`, `s_y`, `a_x`, `a_y`, `diff_x`, `diff_y`, `diff_s_x`, `diff_s_y`, `diff_a_x`, `diff_a_y`



MODEL

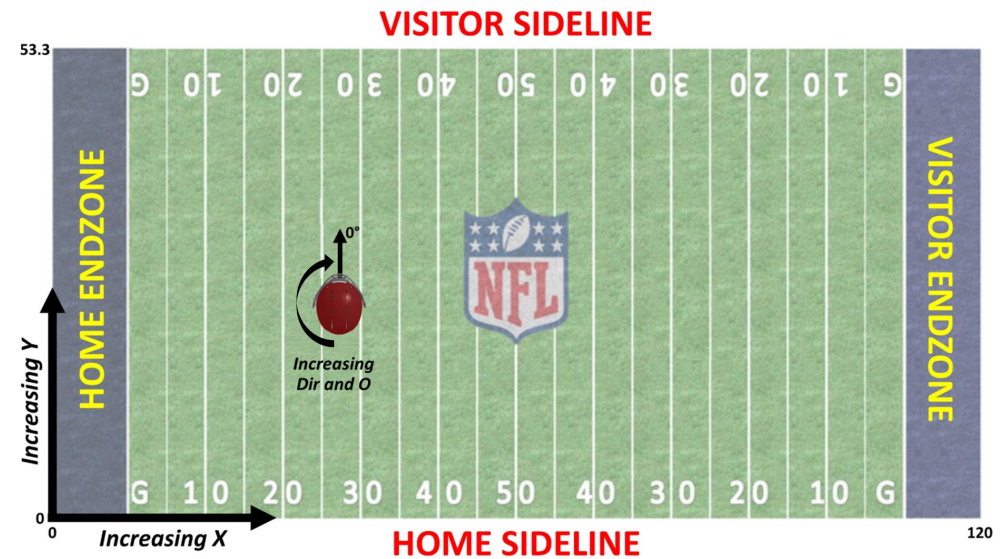
- Convolutional Neural Network
- Leaky ReLU
- Cross Entropy Loss
 - Uses Softmax activation function to classify the play as 1 of the 7
- Training
 - 785 plays
 - Trained over 400 epochs
 - Learning rate of .001
- Test Data
 - 200 plays

```
class Net(nn.Module):
    def __init__(self):
        super().__init__()
        self.conv1 = nn.Conv2d(12,128,1)
        self.pool = nn.MaxPool2d(2, 2)
        self.conv2 = nn.Conv2d(128,160,1)
        self.fc1 = nn.Linear(320, 120)
        self.fc2 = nn.Linear(120, 84)
        self.fc3 = nn.Linear(84, n_coverage)
    def forward(self,x):
        x = self.pool(F.leaky_relu(self.conv1(x)))
        x = self.pool(F.leaky_relu(self.conv2(x)))
        x = torch.flatten(x,1)
        x = F.leaky_relu(self.fc1(x))
        x = F.leaky_relu(self.fc2(x))
        x = self.fc3(x)

        #print(x)
        return x
```

RESULTS

- 53% accurate
 - Better than random (1/7)
- Ways to improve
 - Include orientation to quarterback
 - More weeks of data
 - Use frames from snap to pass
 - Coverages can be disguised pre snap



ETHICS

- Classifying coverages does not present many ethical dilemmas
- However, computer vision and big data in sports does
 - Players don't always have to consent to having data collected
 - Exceptions for certain medical data such as heart rate
 - Player speed and other advanced stats can be used against them in negotiations
 - Players don't always have easy access to this data themselves
 - Problematic since it's their data
 - Also, can't use it to help themselves in negotiations

THANK YOU