

Refitting the Model on New Data

Data Preparation

The following code is the result of triage for what we thought was important for reproducibility of all the research that went into this paper. Other R scripts such as `analysis0.R`, `analysis1.R`, `analysis2.R` contain the messy, yet authentic code that was the outpouring of this modeling process. When someone is attempting to discover something they have quick ideas they don't wanna forget so they just keep coding them up and their organization takes a backseat to discovery and inquiry.

Data Preparation

```
save <- FALSE

tuning_data <- read.csv(here::here("Data", "Interpolated_CompleteSet_May11_FlightData.csv"),
                       header = TRUE)

colnames(tuning_data) <- c("input_psd", "distance", "measured_psd")

tuning_data <- tuning_data |> mutate("transformed_distance" = distance^(-1/1000))
```

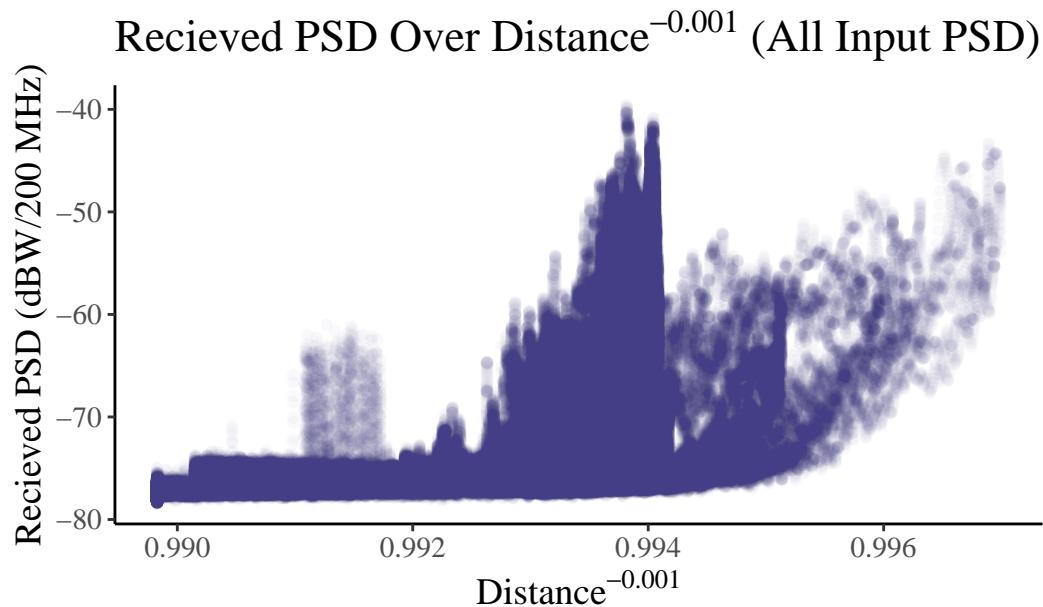
Visualize Training Data

```
tuning_data |>
  ggplot(aes(transformed_distance, measured_psd)) +
  geom_point(color = "#433E85FF", alpha = 0.03) +
  labs(title = TeX("Recieved PSD Over Distance$^{-0.001}$(All Input PSD)"),
       caption = "Data plotted before any added noise with the Distance variable transformed",
       xlab(TeX("Distance$^{-0.001}$")) +
```

```

ylab("Recieved PSD (dBW/200 MHz)") +
theme(text=element_text(family="Times New Roman", size=14),
      plot.caption = element_text(hjust=0.5))

```



Data plotted before any added noise with the Distance variable transformed.

Train/Test Split

```

set.seed(613)
mod_split <- tuning_data |>
  initial_split(
    prop = 0.8
  )

mod_test <- testing(mod_split)
mod_train <- training(mod_split)

```

Model Fitting

```

m1 <- lm(measured_psd ~ input_psd + transformed_distance,
          data = mod_train)

```

```
coef(m1) |> knitr::kable(col.names = c("Variable", "Coefficient Value"))
```

Variable	Coefficient Value
(Intercept)	-8785.7636753
input_psd	0.9996069
transformed_distance	8751.6737698

Model Evaluation

```
pred <- predict(m1, newdata = mod_test)

mod_test <- cbind(mod_test, pred)

# rmse is 0.03657296
mod_rmse <- sqrt(mean((mod_test$measured_psd - mod_test$pred)^2))

# mape is 0.01076367
mod_mape <- mean(abs((mod_test$measured_psd - mod_test$pred) / mod_test$measured_psd)) * 100

# rsq is 0.9999801
summary(m1)$r.squared
# [1] 0.9999801
```