



Appendix 1. Code Snippet of GEDI and Sentinel-2 Data Extraction

```
// Area of Interest (AOI)
var expandedAOI = aoi.buffer(30000);
// Load GEDI Monthly Data (2021–2022)
var gedi =
ee.ImageCollection("LARSE/GEDI/GEDI02_A_002_MONTHLY")
  .filterBounds(expandedAOI)
  .filterDate("2021-01-01", "2022-12-31");
// Generate Median GEDI Image
var gediMedian = gedi.median();
// Sample RH98 from GEDI
var gediPoints = gediMedian.select("rh98").sample({
  region: expandedAOI,
  scale: 25,
  projection: 'EPSG:4326',
  numPixels: 100000,
  geometries: true
});
```

Appendix 2. Code Snippet of AGB Estimation Using RH98

```
// Calculate AGB from RH98
var gediAGB = gediPoints.map(function(feature) {
  var rh98 = feature.getNumber("rh98");
  var agb = ee.Number(2.572).multiply(rh98.pow(1.5191));
  var lonlat = feature.geometry().coordinates();
  return feature.set({
    "RH98": rh98,
    "AGB_RH98": agb,
    "Longitude": lonlat.get(0),
    "Latitude": lonlat.get(1)
  });
});
```

```
});
});
```

Appendix 3. Code Snippet of Sentinel-2 Spectral Band Extraction

```
// Load Sentinel-2 Surface Reflectance (Dry Season)
var sentinel2 = ee.ImageCollection("COPERNICUS/S2_SR")
  .filterBounds(expandedAOI)
  .filterDate("2021-06-01", "2021-09-30")
  .filter(ee.Filter.lt("CLOUDY_PIXEL_PERCENTAGE", 20))
  .mean()
  .select(["B2", "B3", "B4", "B8", "B11", "B12"])
  .resample('bilinear')
  .reproject({
    crs: 'EPSG:4326',
    scale: 25
  });
// Calculate NDVI
var ndvi = sentinel2.normalizedDifference(['B8', 'B4']).rename('NDVI');
sentinel2 = sentinel2.addBands(ndvi);
// Extract Sentinel-2 Values at GEDI Points
var extracted = gediAGB.map(function(feature) {
  var bands = sentinel2.reduceRegion({
    reducer: ee.Reducer.mean(),
    geometry: feature.geometry(),
    scale: 25,
    maxPixels: 1e9
  });
  return feature.set(bands);
});
```

```
}).filter(ee.Filter.notNull(["B2", "B3", "B4", "B8", "B11",
"B12", "NDVI"]));
```

Appendix 4. Code Snippet of XGBoost Regression

```
param_dist_random = {
    "n_estimators": [500, 600, 700],
    "learning_rate": [0.005, 0.01, 0.05],
    "max_depth": [1, 2, 3, 4, 5, 6, 7, 8, 9, 10],
    "subsample": [0.6, 0.7, 0.8, 0.9, 1.0],
    "colsample_bytree": [0.6, 0.7, 0.8, 0.9, 1.0],
    "gamma": [0.0, 0.1, 0.2, 0.3, 0.4, 0.5],
}
xgb_model_for_random = xgb.XGBRegressor(random_state=42)
random_search = RandomizedSearchCV(
    estimator=xgb_model_for_random,
    param_distributions=param_dist_random,
    n_iter=100,
    cv=5,
    verbose=2,
    random_state=42,
    n_jobs=-1,
    scoring="r2",
)
random_search.fit(X_train, y_train)
...
...
best_xgb_random = random_search.best_estimator_
y_pred_random = best_xgb_random.predict(X_test)
rmse_random = np.sqrt(mean_squared_error(y_test,
y_pred_random))
```

```
r2_random = r2_score(y_test, y_pred_random)
```

Appendix 5. Code Snippet of Random Forest Regression

```
# Select input features and target
X = data[["NDVI", "EVI", "NDMI", "NDWI"]]
y = data["AGB_RH98"]
# Logarithmic transformation of target variable
y_transformed = np.log1p(y)
# Split data
X_train, X_test, y_train, y_test = train_test_split(
    X, y_transformed, test_size=0.2, random_state=42
)
...
...
# Grid Search configuration for Random Forest
param_grid = {
    "n_estimators": [500, 700, 1000],
    "max_depth": [10, 20, 30, None],
    "min_samples_split": [2, 5, 10],
    "min_samples_leaf": [1, 2, 4],
    "max_features": ["sqrt", "log2", 0.8],
}
rf = RandomForestRegressor(random_state=42)
grid_search = GridSearchCV(
    estimator=rf,
    param_grid=param_grid,
    cv=5,
```

```
n_jobs=-1,  
verbose=2,  
scoring="r2",  
)  
grid_search.fit(X_train, y_train)
```



BIOGRAPHY



Gede Andra Rizqy Wijaya was born in Singaraja on June 30, 2004. The author of this work is the son of Komang Suhartana Wijaya and Ni Luh Suci Ariyati. The author is an Indonesian citizen and a Hindu. The author live in Kaliuntu, Buleleng District,, Buleleng Regency. The author completed his elementary education at SD Negeri 9 Benoa and graduated in 2016. The author continued his education in SMP Negeri 1 Kuta for 1 year then move to SMP Negeri 1 Singaraja to finish his junior school education. His move is because of the author parent want to go back to Singaraja to stay. After finishing his junior school education in 2019, he continued to finish his high school education at SMA Negeri 1 Singaraja. The author graduated from SMA Negeri 1 Singaraja in 2022. The author is registered as a student of the Computer Science Undergraduate Study Program at Universitas Pendidikan Ganesha from 2022 until the writing of this undergraduate thesis.

