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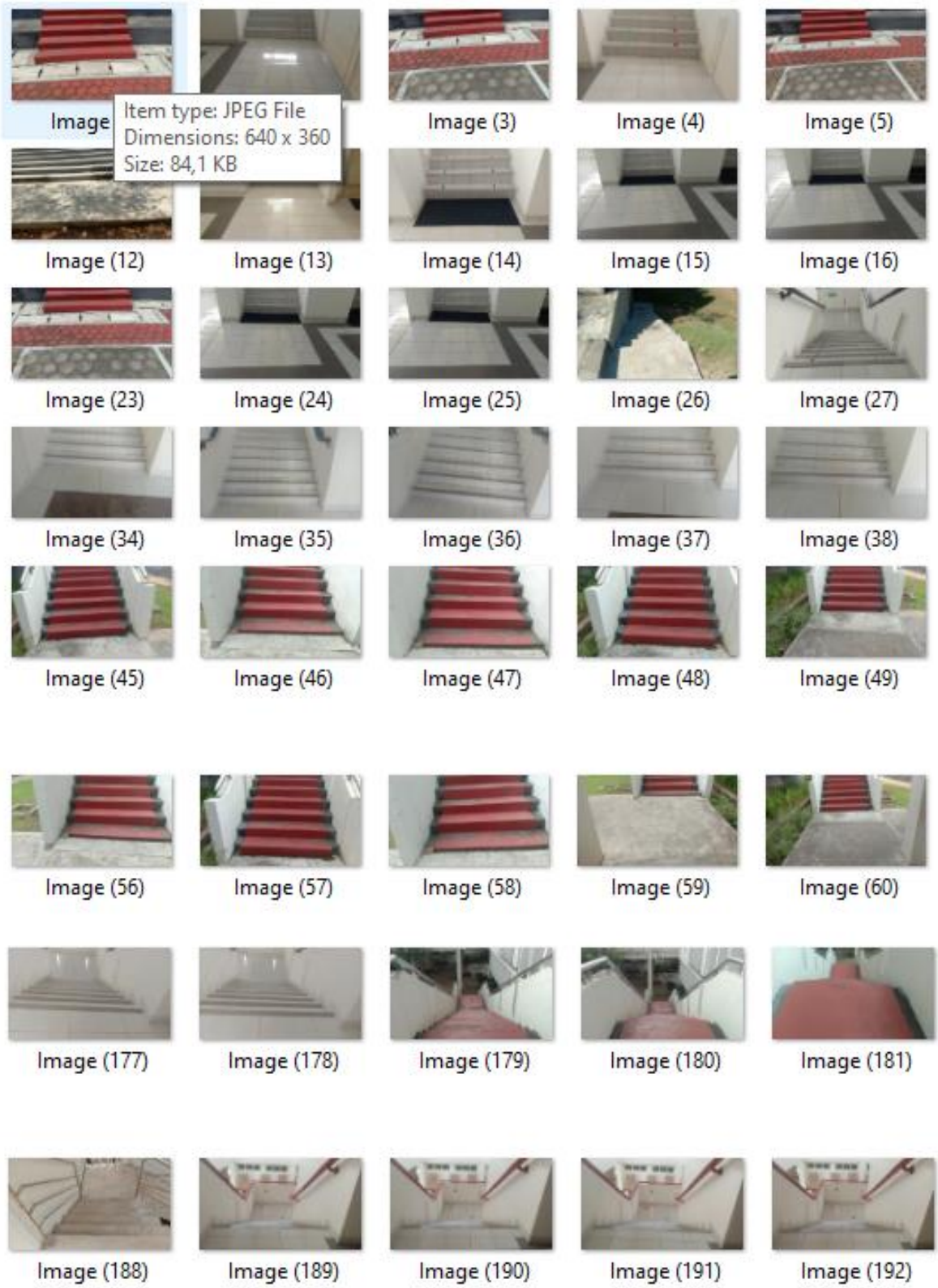
LAMPIRAN

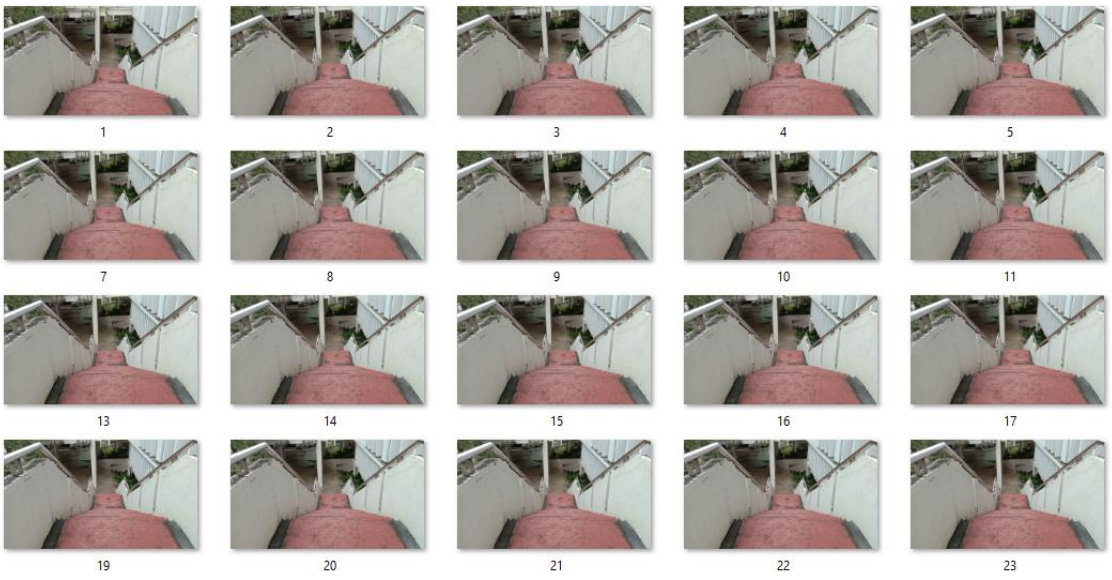
1. Contoh Data Training



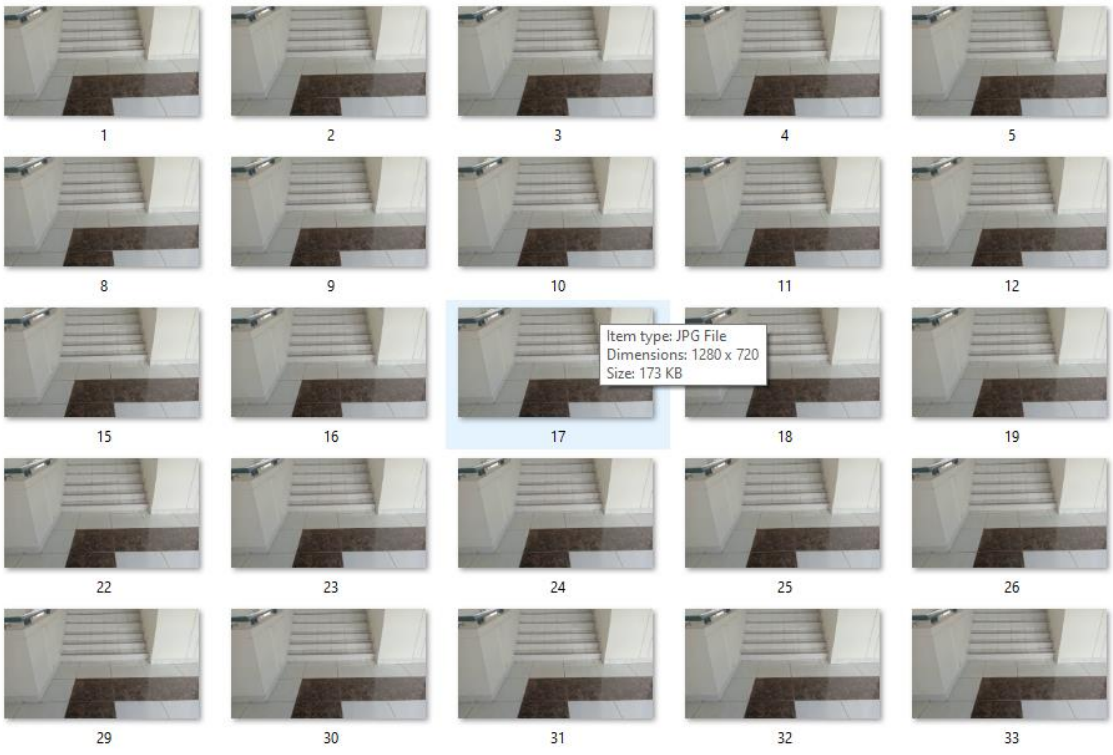
2. Contoh Data Testing

- **Contoh *Frame* Tangga Naik Gedung CSA**

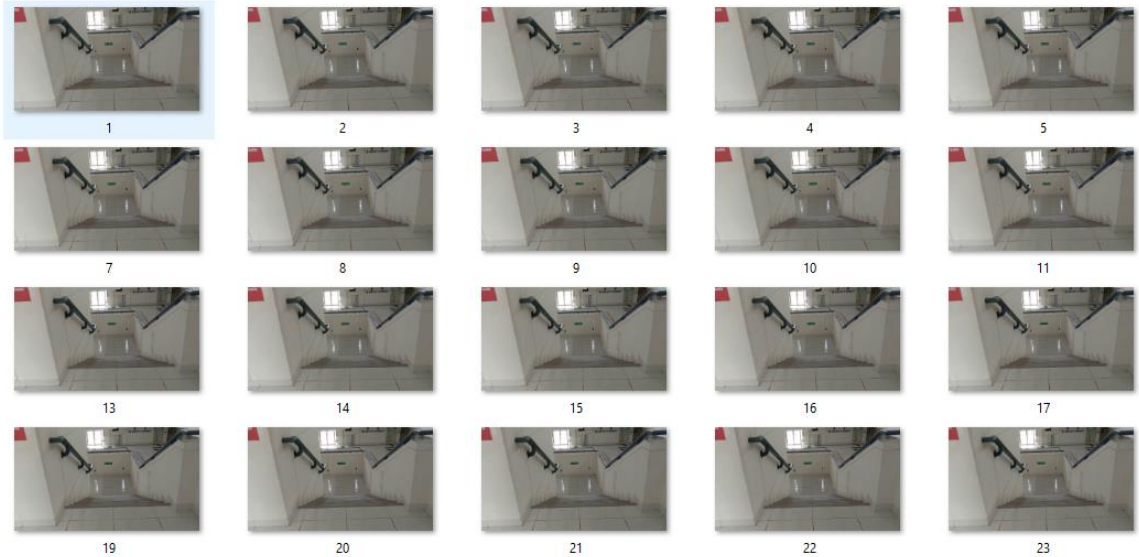
- **Contoh *Frame* Tangga Turun Gedung CSA**



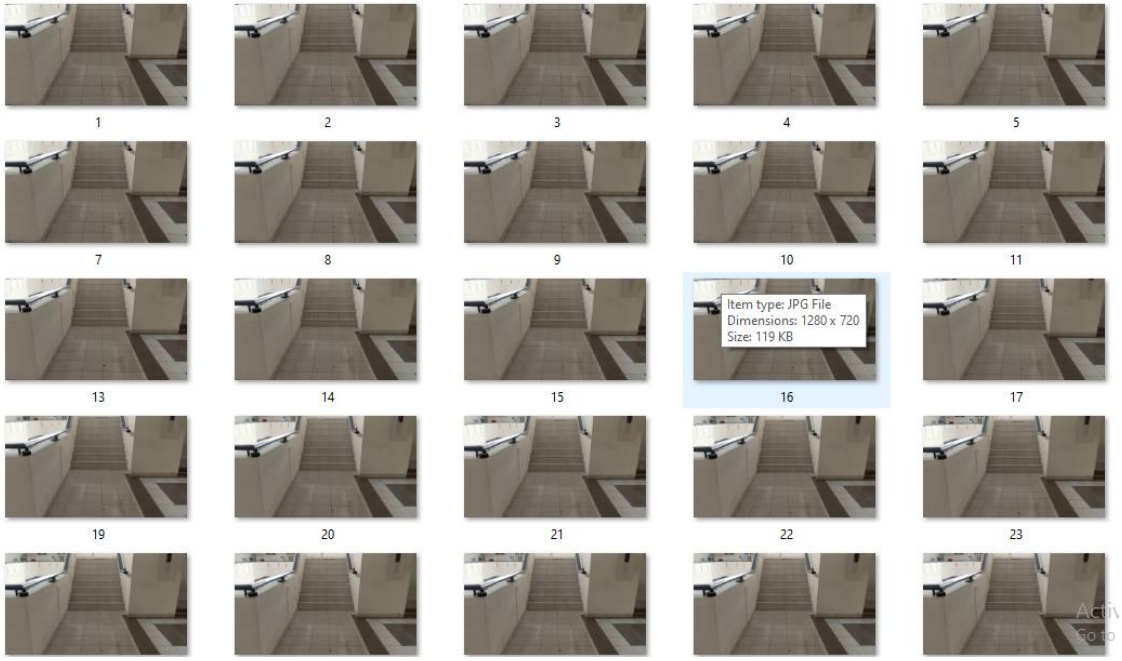
- **Contoh *Frame* Tangga Naik Gedung Elektro**



- **Contoh *Frame* Tangga Turun Gedung Elektro**

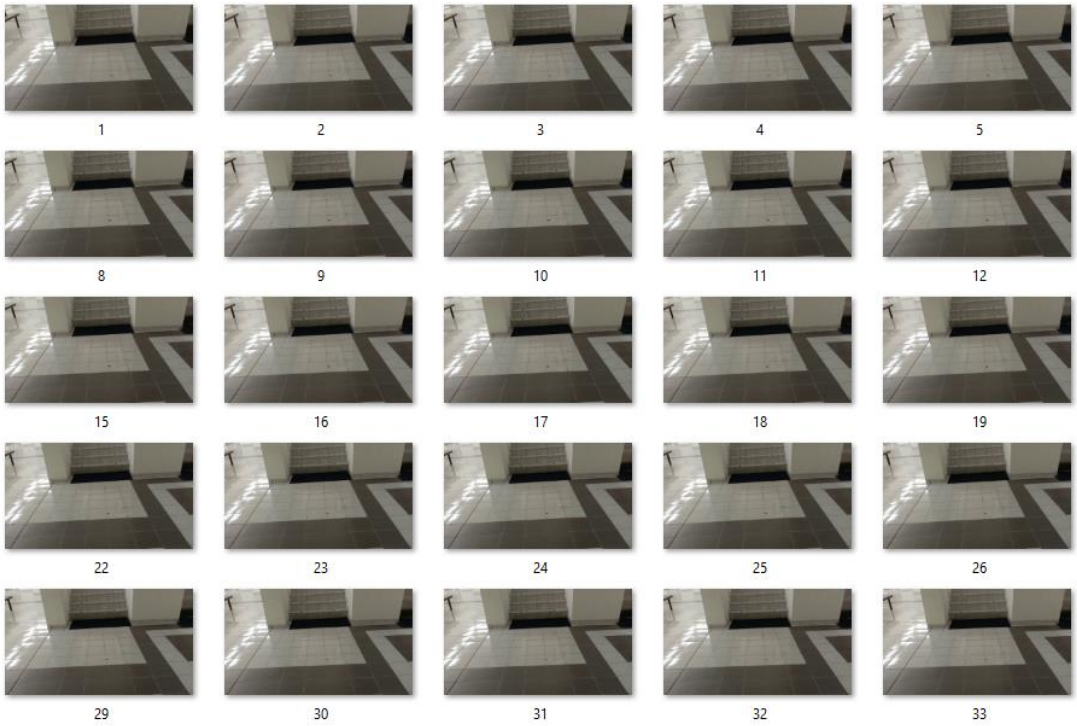


- **Contoh *Frame* Tangga Naik Gedung Sipil**



- **Contoh *Frame* Tangga Turun Gedung Sipil**

- **Contoh *Frame* Tangga Naik Gedung Geologi**



- **Contoh *Frame* Tangga Turun Gedung Geologi**

3. Training Model SSD

```
import json
import os
import tensorflow as tf

from object_detection.builders import dataset_builder
from object_detection.builders import graph_rewriter_builder
from object_detection.builders import model_builder
from object_detection.legacy import trainer
from object_detection.utils import config_util

tf.logging.set_verbosity(tf.logging.INFO)

flags = tf.app.flags
flags.DEFINE_string('master', '', 'Name of the TensorFlow master to use.')
flags.DEFINE_integer('task', 0, 'task id')
flags.DEFINE_integer('num_clones', 1, 'Number of clones to deploy per
worker.')
flags.DEFINE_boolean('clone_on_cpu', False,
                     'Force clones to be deployed on CPU.  Note that even if '
                     'set to False (allowing ops to run on gpu), some ops may '
                     'still be run on the CPU if they have no GPU kernel.')
flags.DEFINE_integer('worker_replicas', 1, 'Number of worker+trainer '
                     'replicas.')
flags.DEFINE_integer('ps_tasks', 0,
                     'Number of parameter server tasks. If None, does not use '
                     'a parameter server.')
flags.DEFINE_string('train_dir', '',
                    'Directory to save the checkpoints and training summaries.')

flags.DEFINE_string('pipeline_config_path', '',
                    'Path to a pipeline_pb2.TrainEvalPipelineConfig config '
                    'file. If provided, other configs are ignored')

flags.DEFINE_string('train_config_path', '',
                    'Path to a train_pb2.TrainConfig config file.')
flags.DEFINE_string('input_config_path', '',
                    'Path to an input_reader_pb2.InputReader config file.')
flags.DEFINE_string('model_config_path', '',
```

```
                'Path to a model_pb2.DetectionModel config file.')

FLAGS = flags.FLAGS


@tf.contrib.framework.deprecated(None, 'Use
object_detection/model_main.py.')
def main(_):
  assert FLAGS.train_dir, '`train_dir` is missing.'
  if FLAGS.task == 0: tf.gfile.MakeDirs(FLAGS.train_dir)
  if FLAGS.pipeline_config_path:
    configs = config_util.get_configs_from_pipeline_file(
        FLAGS.pipeline_config_path)
    if FLAGS.task == 0:
      tf.gfile.Copy(FLAGS.pipeline_config_path,
                    os.path.join(FLAGS.train_dir, 'pipeline.config'),
                    overwrite=True)
  else:
    configs = config_util.get_configs_from_multiple_files(
        model_config_path=FLAGS.model_config_path,
        train_config_path=FLAGS.train_config_path,
        train_input_config_path=FLAGS.input_config_path)
    if FLAGS.task == 0:
      for name, config in [('model.config', FLAGS.model_config_path),
                           ('train.config', FLAGS.train_config_path),
                           ('input.config', FLAGS.input_config_path)]:
        tf.gfile.Copy(config, os.path.join(FLAGS.train_dir, name),
                      overwrite=True)

  model_config = configs['model']
  train_config = configs['train_config']
  input_config = configs['train_input_config']

  model_fn = functools.partial(
      model_builder.build,
      model_config=model_config,
      is_training=True)

  def get_next(config):
    return dataset_builder.make_initializable_iterator(
```

```
    dataset_builder.build(config)).get_next()

create_input_dict_fn = functools.partial(get_next, input_config)

env = json.loads(os.environ.get('TF_CONFIG', '{}'))
cluster_data = env.get('cluster', None)
cluster = tf.train.ClusterSpec(cluster_data) if cluster_data else None
task_data = env.get('task', None) or {'type': 'master', 'index': 0}
task_info = type('TaskSpec', (object,), task_data)

# Parameters for a single worker.
ps_tasks = 0
worker_replicas = 1
worker_job_name = 'lonely_worker'
task = 0
is_chief = True
master = ''

if cluster_data and 'worker' in cluster_data:
  # Number of total worker replicas include "worker"s and the "master".
  worker_replicas = len(cluster_data['worker']) + 1
if cluster_data and 'ps' in cluster_data:
  ps_tasks = len(cluster_data['ps'])

if worker_replicas > 1 and ps_tasks < 1:
  raise ValueError('At least 1 ps task is needed for distributed training.')

if worker_replicas >= 1 and ps_tasks > 0:
  # Set up distributed training.
  server = tf.train.Server(tf.train.ClusterSpec(cluster), protocol='grpc',
                           job_name=task_info.type,
                           task_index=task_info.index)
  if task_info.type == 'ps':
    server.join()
    return

  worker_job_name = '%s/task:%d' % (task_info.type, task_info.index)
  task = task_info.index
  is_chief = (task_info.type == 'master')
  master = server.target
```

```
graph_rewriter_fn = None
if 'graph_rewriter_config' in configs:
  graph_rewriter_fn = graph_rewriter_builder.build(
      configs['graph_rewriter_config'], is_training=True)

trainer.train(
    create_input_dict_fn,
    model_fn,
    train_config,
    master,
    task,
    FLAGS.num_clones,
    worker_replicas,
    FLAGS.clone_on_cpu,
    ps_tasks,
    worker_job_name,
    is_chief,
    FLAGS.train_dir,
    graph_hook_fn=graph_rewriter_fn)


if __name__ == '__main__':
  tf.app.run()
```

4. Export Graph Model

```
import tensorflow as tf
from google.protobuf import text_format
from object_detection import exporter
from object_detection.protos import pipeline_pb2

slim = tf.contrib.slim
flags = tf.app.flags

flags.DEFINE_string('input_type', 'image_tensor', 'Type of input node.
Can be '
                    'one of [`image_tensor`, `encoded_image_string_tensor`, '
                    '`tf_example`]')
```

```
flags.DEFINE_string('input_shape', None,
                    'If input_type is `image_tensor`, this can explicitly set '
                    'the shape of this input tensor to a fixed size. The '
                    'dimensions are to be provided as a comma-separated list '
                    'of integers. A value of -1 can be used for unknown '
                    'dimensions. If not specified, for an `image_tensor, the '
                    'default shape will be partially specified as '
                    '`[None, None, None, 3]`.')
flags.DEFINE_string('pipeline_config_path', None,
                    'Path to a pipeline_pb2.TrainEvalPipelineConfig config '
                    'file.')
flags.DEFINE_string('trained_checkpoint_prefix', None,
                    'Path to trained checkpoint, typically of the form '
                    'path/to/model.ckpt')
flags.DEFINE_string('output_directory', None, 'Path to write outputs.')
flags.DEFINE_string('config_override', '',
                    'pipeline_pb2.TrainEvalPipelineConfig '
                    'text proto to override pipeline_config_path.')
flags.DEFINE_boolean('write_inference_graph', False,
                     'If true, writes inference graph to disk.')
tf.app.flags.mark_flag_as_required('pipeline_config_path')
tf.app.flags.mark_flag_as_required('trained_checkpoint_prefix')
tf.app.flags.mark_flag_as_required('output_directory')
FLAGS = flags.FLAGS


def main(_):
  pipeline_config = pipeline_pb2.TrainEvalPipelineConfig()
  with tf.gfile.GFile(FLAGS.pipeline_config_path, 'r') as f:
    text_format.Merge(f.read(), pipeline_config)
  text_format.Merge(FLAGS.config_override, pipeline_config)
  if FLAGS.input_shape:
    input_shape = [
        int(dim) if dim != '-1' else None
        for dim in FLAGS.input_shape.split(',')
    ]
  else:
    input_shape = None
  exporter.export_inference_graph(
```

FLAGS.input_type, pipeline_config,
FLAGS.trained_checkpoint_prefix,
FLAGS.output_directory, input_shape=input_shape,
write_inference_graph=FLAGS.write_inference_graph)

if __name__ == '__main__':
tf.app.run()

5. Deteksi Tiang

```
public class TensorFlowObjectDetectionAPIModel
implements Classifier {
  private static final Logger LOGGER = new Logger();

  // Only return this many results.
  private static final int MAX_RESULTS = 100;

  // Config values.
  private String inputName;
  private int inputSize;

  // Pre-allocated buffers.
  private Vector<String> labels = new
Vector<String>();
  private int[] intValues;
  private byte[] byteValues;
  private float[] outputLocations;
  private float[] outputScores;
  private float[] outputClasses;
  private float[] outputNumDetections;
  private String[] outputNames;

  private boolean logStats = false;

  private TensorFlowInferenceInterface
inferenceInterface;

  /**
   * Initializes a native TensorFlow session for
```

```
classifying images.
   *
   * @param assetManager The asset manager to be
used to load assets.
   * @param modelFilename The filepath of the model
GraphDef protocol buffer.
   * @param labelFilename The filepath of label file
for classes.
   */
  public static Classifier create(
      final AssetManager assetManager,
      final String modelFilename,
      final String labelFilename,
      final int inputSize) throws IOException {
    final TensorFlowObjectDetectionAPIModel d = new
TensorFlowObjectDetectionAPIModel();

    InputStream labelsInput = null;
    String actualFilename =
labelFilename.split("file:///android_asset/")[1];
    labelsInput = assetManager.open(actualFilename);
    BufferedReader br = null;
    br = new BufferedReader(new
InputStreamReader(labelsInput));
    String line;
    while ((line = br.readLine()) != null) {
      LOGGER.w(line);
      d.labels.add(line);
    }
    br.close();


    d.inferenceInterface = new
TensorFlowInferenceInterface(assetManager,
modelFilename);

    final Graph g = d.inferenceInterface.graph();

    d.inputName = "image_tensor";
    // The inputName node has a shape of [N, H, W,
C], where
```

```
    // N is the batch size
    // H = W are the height and width
    // C is the number of channels (3 for our
purposes - RGB)
    final Operation inputOp =
g.operation(d.inputName);
    if (inputOp == null) {
      throw new RuntimeException("Failed to find
input Node '" + d.inputName + "'");
    }
    d.inputSize = inputSize;
    // The outputScoresName node has a shape of [N,
NumLocations], where N
    // is the batch size.
    final Operation outputOp1 =
g.operation("detection_scores");
    if (outputOp1 == null) {
      throw new RuntimeException("Failed to find
output Node 'detection_scores'");
    }
    final Operation outputOp2 =
g.operation("detection_boxes");
    if (outputOp2 == null) {
      throw new RuntimeException("Failed to find
output Node 'detection_boxes'");
    }
    final Operation outputOp3 =
g.operation("detection_classes");
    if (outputOp3 == null) {
      throw new RuntimeException("Failed to find
output Node 'detection_classes'");
    }

    // Pre-allocate buffers.
    d.outputNames = new String[] {"detection_boxes",
"detection_scores",

"detection_classes", "num_detections"};
    d.intValues = new int[d.inputSize *
d.inputSize];
    d.byteValues = new byte[d.inputSize *
```

```
d.inputSize * 3];
    d.outputScores = new float[MAX_RESULTS];
    d.outputLocations = new float[MAX_RESULTS * 4];
    d.outputClasses = new float[MAX_RESULTS];
    d.outputNumDetections = new float[1];
    return d;
  }

  private TensorFlowObjectDetectionAPIModel() {}

  @Override
  public List<Recognition> recognizeImage(final
Bitmap bitmap) {
    // Log this method so that it can be analyzed
with systrace.
    Trace.beginSection("recognizeImage");

    Trace.beginSection("preprocessBitmap");
    // Preprocess the image data to extract R, G and
B bytes from int of form 0x00RRGGBB
    // on the provided parameters.
    bitmap.getPixels(intValues, 0,
bitmap.getWidth(), 0, 0, bitmap.getWidth(),
bitmap.getHeight());

    for (int i = 0; i < intValues.length; ++i) {
      byteValues[i * 3 + 2] = (byte) (intValues[i] &
0xFF);
      byteValues[i * 3 + 1] = (byte) ((byteValues[i
* 3 + 0] = (byte) ((intValues[i] >> 16) & 0xFF);
    }
    Trace.endSection(); // preprocessBitmap

    // Copy the input data into TensorFlow.
    Trace.beginSection("feed");
    inferenceInterface.feed(intValues[i] >> 8) &
0xFF);
      inputName, byteValues, 1, inputSize,
inputSize, 3);
    Trace.endSection();
```

```
    // Run the inference call.
    Trace.beginSection("run");
    inferenceInterface.run(outputNames, logStats);
    Trace.endSection();

    // Copy the output Tensor back into the output
array.
    Trace.beginSection("fetch");
    outputLocations = new float[MAX_RESULTS * 4];
    outputScores = new float[MAX_RESULTS];
    outputClasses = new float[MAX_RESULTS];
    outputNumDetections = new float[1];
    inferenceInterface.fetch(outputNames[0],
outputLocations);
    inferenceInterface.fetch(outputNames[1],
outputScores);
    inferenceInterface.fetch(outputNames[2],
outputClasses);
    inferenceInterface.fetch(outputNames[3],
outputNumDetections);
    Trace.endSection();

    // Find the best detections.
    final PriorityQueue<Recognition> pq =
        new PriorityQueue<Recognition>(
            1,
            new Comparator<Recognition>() {
              @Override
              public int compare(final Recognition
lhs, final Recognition rhs) {
                // Intentionally reversed to put
high confidence at the head of the queue.
                return
Float.compare(rhs.getConfidence(),
lhs.getConfidence());
              }
            });

    // Scale them back to the input size.
    for (int i = 0; i < outputScores.length; ++i) {
      final RectF detection =
```

```
            new RectF(
                outputLocations[4 * i + 1] *
inputSize,
                outputLocations[4 * i] * inputSize,
                outputLocations[4 * i + 3] *
inputSize,
                outputLocations[4 * i + 2] *
inputSize);
        pq.add(
            new Recognition("" + i, labels.get((int)
outputClasses[i]), outputScores[i], detection));
      }

      final ArrayList<Recognition> recognitions = new
ArrayList<Recognition>();
      for (int i = 0; i < Math.min(pq.size(),
MAX_RESULTS); ++i) {
        recognitions.add(pq.poll());
      }
      Trace.endSection(); // "recognizeImage"
      return recognitions;
    }

    @Override
    public void enableStatLogging(final boolean
logStats) {
      this.logStats = logStats;
    }

    @Override
    public String getStatString() {
      return inferenceInterface.getStatString();
    }

    @Override
    public void close() {
      inferenceInterface.close();
    }
}
```

6. Estimasi Jarak

```
public class MultiBoxTracker {
    public String Hasil;
  private final Logger logger = new Logger();

  private static final float TEXT_SIZE_DIP = 18;

  // Maximum percentage of a box that can be
overlapped by another box at detection time.
Otherwise
  // the lower scored box (new or old) will be
removed.
  private static final float MAX_OVERLAP = 0.2f;

  private static final float MIN_SIZE = 16.0f;

  // Allow replacement of the tracked box with new
results if
  // correlation has dropped below this level.
  private static final float MARGINAL_CORRELATION
= 0.75f;

  // Consider object to be lost if correlation
falls below this threshold.
  private static final float MIN_CORRELATION =
0.3f;

  private static final int[] COLORS = {
          Color.BLUE, Color.RED, Color.GREEN,
Color.YELLOW, Color.CYAN, Color.MAGENTA,
Color.WHITE,
          Color.parseColor("#55FF55"),
Color.parseColor("#FFA500"),
Color.parseColor("#FF8888"),
          Color.parseColor("#AAAAFF"),
Color.parseColor("#FFFFAA"),
Color.parseColor("#55AAAA"),
          Color.parseColor("#AA33AA"),
Color.parseColor("#0D0068")
  };

  private final Queue<Integer> availableColors =
new LinkedList<Integer>();

  public ObjectTracker objectTracker;
```

```
  final List<Pair<Float, RectF>> screenRects = new
LinkedList<Pair<Float, RectF>>();

  private static class TrackedRecognition {
    ObjectTracker.TrackedObject trackedObject;
    RectF location;
    float detectionConfidence;
    int color;
    String title;
  }

  private final List<TrackedRecognition>
trackedObjects = new
LinkedList<TrackedRecognition>();

  private final Paint boxPaint = new Paint();

  private final float textSizePx;
  private final BorderedText borderedText;

  private Matrix frameToCanvasMatrix;

  private int frameWidth;
  private int frameHeight;

  private int sensorOrientation;
  private Context context;

  public MultiBoxTracker(final Context context) {
    this.context = context;
    for (final int color : COLORS) {
      availableColors.add(color);
    }

    boxPaint.setColor(Color.RED);
    boxPaint.setStyle(Style.STROKE);
    boxPaint.setStrokeWidth(12.0f);
    boxPaint.setStrokeCap(Cap.ROUND);
    boxPaint.setStrokeJoin(Join.ROUND);
    boxPaint.setStrokeMiter(100);

    textSizePx =
            TypedValue.applyDimension(
                    TypedValue.COMPLEX_UNIT_DIP,
TEXT_SIZE_DIP,
context.getResources().getDisplayMetrics());
```

```
    borderedText = new BorderedText(textSizePx);
  }

  private Matrix getFrameToCanvasMatrix() {
    return frameToCanvasMatrix;
  }

  public synchronized void drawDebug(final Canvas
canvas) {
    final Paint textPaint = new Paint();
    textPaint.setColor(Color.WHITE);
    textPaint.setTextSize(60.0f);

    final Paint boxPaint = new Paint();
    boxPaint.setColor(Color.RED);
    boxPaint.setAlpha(200);
    boxPaint.setStyle(Style.STROKE);

    for (final Pair<Float, RectF> detection :
screenRects) {
      final RectF rect = detection.second;
      canvas.drawRect(rect, boxPaint);
      canvas.drawText("" + detection.first,
rect.left, rect.top, textPaint);
      borderedText.drawText(canvas,
rect.centerX(), rect.centerY(), "" +
detection.first);
    }

    if (objectTracker == null) {
      return;
    }

    // Draw correlations.
    for (final TrackedRecognition recognition :
trackedObjects) {
      final ObjectTracker.TrackedObject
trackedObject = recognition.trackedObject;

      final RectF trackedPos =
trackedObject.getTrackedPositionInPreviewFrame();

      if
(getFrameToCanvasMatrix().mapRect(trackedPos)) {
        final String labelString =
String.format("%.2f",
trackedObject.getCurrentCorrelation());
```

```
        borderedText.drawText(canvas,
trackedPos.right, trackedPos.bottom, labelString);
      }
    }

    final Matrix matrix =
getFrameToCanvasMatrix();
    objectTracker.drawDebug(canvas, matrix);
  }

  public synchronized void trackResults(
          final List<Recognition> results, final
byte[] frame, final long timestamp) {
    logger.i("Processing %d results from %d",
results.size(), timestamp);
    processResults(timestamp, results, frame);
  }

  public synchronized void draw(final Canvas
canvas) {
    final boolean rotated = sensorOrientation %
180 == 90;
    final float multiplier =
            Math.min(canvas.getHeight() / (float)
(rotated ? frameWidth : frameHeight),
                    canvas.getWidth() / (float)
(rotated ? frameHeight : frameWidth));
    frameToCanvasMatrix =
            ImageUtils.getTransformationMatrix(
                    frameWidth,
                    frameHeight,
                    (int) (multiplier * (rotated ?
frameHeight : frameWidth)),
                    (int) (multiplier * (rotated ?
frameWidth : frameHeight)),
                    sensorOrientation,
                    false);
    for (final TrackedRecognition recognition :
trackedObjects) {
      final RectF trackedPos =
              (objectTracker != null)
                      ?
recognition.trackedObject.getTrackedPositionInPrev
iewFrame()
                      : new
RectF(recognition.location);
```

```
getFrameToCanvasMatrix().mapRect(trackedPos);
      boxPaint.setColor(recognition.color);
      boxPaint.setStrokeWidth(2.0f);

      final Paint paint = new Paint();
      paint.setColor(Color.YELLOW);
      paint.setStyle(Style.STROKE);
      paint.setStrokeWidth(2.0f);
      canvas.drawLine(canvas.getWidth()/2, 0,
canvas.getWidth()/2, canvas.getHeight(), paint);

      final float cornerSize =
Math.min(trackedPos.width(), trackedPos.height())
/ 8.0f;
      float Xmin = (trackedPos.left / 720) * 1280;
      float Ymin = trackedPos.top;
      float Xmax = (trackedPos.right / 720) *
1280;
      float Ymax = trackedPos.bottom;
      trackedPos.set(Xmin, Ymin, Xmax, Ymax);
      canvas.drawRect(trackedPos, boxPaint);

      //variabel referensi jarak
      float jarak2 = 2;
      float jarak3 = 3;
      float jarak4 = 4;
      float jarak5 = 5;
      float ref2 = 603; //(800 / 1080) * 720;
      float ref3 = 450; //(700 / 1080) * 720;
      float ref4 = 337; //(610 / 1080) * 720;
      float ref5 = 316; //(410 / 1080) * 720;

      final Paint paint2 = new Paint();
      paint2.setColor(Color.YELLOW);
      paint2.setStyle(Style.STROKE);
      paint2.setStrokeWidth(0.5f);

      canvas.drawLine(0, ref5,
canvas.getWidth(),ref5, paint2);
      canvas.drawLine(0, ref4,
canvas.getWidth(),ref4, paint2);
      canvas.drawLine(0, ref3,
canvas.getWidth(),ref3, paint2);
      canvas.drawLine(0, ref2,
canvas.getWidth(),ref2, paint2);
```

```
        //perhitungan selisih terkecil
        float S2, S3, S4, S5, Sok = 0, Jok = 0;
        S2 = Math.abs(Ymax - ref2);
        S3 = Math.abs(Ymax - ref3);
        S4 = Math.abs(Ymax - ref4);
        S5 = Math.abs(Ymax - ref5);

        if ((S2 < S3) && (S2 < S4) && (S2 < S5)){
          Sok = ref2;
          Jok = jarak2;
        }
        else if ((S3 < S5) && (S3 < S4) && (S3 <
S2)){
          Sok = ref3;
          Jok = jarak3;
        }
        else if ((S4 < S3) && (S4 < S2) && (S4 <
S5)){
          Sok = ref4;
          Jok = jarak4;
        }
        else if ((S5 < S3) && (S5 < S4) && (S5 <
S2)){
          Sok = ref5;
          Jok = jarak5;
        }

        //perhitungan jarak estimasi
        float jarak_estimasi;
        jarak_estimasi = (Sok * Jok) / Ymax;

//
        Hasil = String.format("%.1f meter",
jarak_estimasi);
        borderedText.drawText(canvas,
trackedPos.left + cornerSize, trackedPos.bottom,
Hasil);

      }
    }

  public static int indexOfSmallest(int[] array){

    // add this
    if (array.length == 0)
      return -1;
```

```
    int index = 0;
    int min = array[index];

    for (int i = 1; i < array.length; i++){
      if (array[i] <= min){
        min = array[i];
        index = i;
      }
    }
    return index;
  }

  private boolean initialized = false;

  public synchronized void onFrame(
          final int w,
          final int h,
          final int rowStride,
          final int sensorOrientation,
          final byte[] frame,
          final long timestamp) {
    if (objectTracker == null && !initialized) {
      ObjectTracker.clearInstance();

      logger.i("Initializing ObjectTracker:
%dx%d", w, h);
      objectTracker = ObjectTracker.getInstance(w,
h, rowStride, true);
      frameWidth = w;
      frameHeight = h;
      this.sensorOrientation = sensorOrientation;
      initialized = true;

      if (objectTracker == null) {
        String message =
                "Object tracking support not
found. "
                        + "See
tensorflow/examples/android/README.md for
details.";
        Toast.makeText(context, message,
Toast.LENGTH_LONG).show();
        logger.e(message);
      }
    }

    if (objectTracker == null) {
```

```
      return;
    }

    objectTracker.nextFrame(frame, null,
timestamp, null, true);

    // Clean up any objects not worth tracking any
more.
    final LinkedList<TrackedRecognition> copyList
=
            new
LinkedList<TrackedRecognition>(trackedObjects);
    for (final TrackedRecognition recognition :
copyList) {
      final ObjectTracker.TrackedObject
trackedObject = recognition.trackedObject;
      final float correlation =
trackedObject.getCurrentCorrelation();
      if (correlation < MIN_CORRELATION) {
        logger.v("Removing tracked object %s
because NCC is %.2f", trackedObject, correlation);
        trackedObject.stopTracking();
        trackedObjects.remove(recognition);

        availableColors.add(recognition.color);
      }
    }
  }

  private void processResults(
          final long timestamp, final
List<Recognition> results, final byte[]
originalFrame) {
    final List<Pair<Float, Recognition>>
rectsToTrack = new LinkedList<Pair<Float,
Recognition>>();

    screenRects.clear();
    final Matrix rgbFrameToScreen = new
Matrix(getFrameToCanvasMatrix());

    for (final Recognition result : results) {
      if (result.getLocation() == null) {
        continue;
      }
      final RectF detectionFrameRect = new
RectF(result.getLocation());
```

```
      final RectF detectionScreenRect = new
RectF();

rgbFrameToScreen.mapRect(detectionScreenRect,
detectionFrameRect);

      logger.v(
              "Result! Frame: " +
result.getLocation() + " mapped to screen:" +
detectionScreenRect);

      screenRects.add(new Pair<Float,
RectF>(result.getConfidence(),
detectionScreenRect));

      if (detectionFrameRect.width() < MIN_SIZE ||
detectionFrameRect.height() < MIN_SIZE) {
        logger.w("Degenerate rectangle! " +
detectionFrameRect);
        continue;
      }

      rectsToTrack.add(new Pair<Float,
Recognition>(result.getConfidence(), result));
    }

    if (rectsToTrack.isEmpty()) {
      logger.v("Nothing to track, aborting.");
      return;
    }

    if (objectTracker == null) {
      trackedObjects.clear();
      for (final Pair<Float, Recognition>
potential : rectsToTrack) {
        final TrackedRecognition
trackedRecognition = new TrackedRecognition();
        trackedRecognition.detectionConfidence =
potential.first;
        trackedRecognition.location = new
RectF(potential.second.getLocation());
        trackedRecognition.trackedObject = null;
        trackedRecognition.title =
potential.second.getTitle();
        trackedRecognition.color =
COLORS[trackedObjects.size()];
```

```
        trackedObjects.add(trackedRecognition);

        if (trackedObjects.size() >=
COLORS.length) {
          break;
        }
      }
      return;
    }

    logger.i("%d rects to track",
rectsToTrack.size());
    for (final Pair<Float, Recognition> potential
: rectsToTrack) {
      handleDetection(originalFrame, timestamp,
potential);
    }
  }

  private void handleDetection(
          final byte[] frameCopy, final long
timestamp, final Pair<Float, Recognition>
potential) {
    final ObjectTracker.TrackedObject
potentialObject =

objectTracker.trackObject(potential.second.getLoca
tion(), timestamp, frameCopy);

    final float potentialCorrelation =
potentialObject.getCurrentCorrelation();
    logger.v(
            "Tracked object went from %s to %s
with correlation %.2f",
            potential.second,
potentialObject.getTrackedPositionInPreviewFrame()
, potentialCorrelation);

    if (potentialCorrelation <
MARGINAL_CORRELATION) {
      logger.v("Correlation too low to begin
tracking %s.", potentialObject);
      potentialObject.stopTracking();
      return;
    }

    final List<TrackedRecognition> removeList =
```

```
new LinkedList<TrackedRecognition>();

    float maxIntersect = 0.0f;

    // This is the current tracked object whose
color we will take. If left null we'll take the
    // first one from the color queue.
    TrackedRecognition recogToReplace = null;

    // Look for intersections that will be
overridden by this object or an intersection that
would
    // prevent this one from being placed.
    for (final TrackedRecognition
trackedRecognition : trackedObjects) {
      final RectF a =
trackedRecognition.trackedObject.getTrackedPositio
nInPreviewFrame();
      final RectF b =
potentialObject.getTrackedPositionInPreviewFrame()
;
      final RectF intersection = new RectF();
      final boolean intersects =
intersection.setIntersect(a, b);

      final float intersectArea =
intersection.width() * intersection.height();
      final float totalArea = a.width() *
a.height() + b.width() * b.height() -
intersectArea;
      final float intersectOverUnion =
intersectArea / totalArea;

      // If there is an intersection with this
currently tracked box above the maximum overlap
      // percentage allowed, either the new
recognition needs to be dismissed or the old
      // recognition needs to be removed and
possibly replaced with the new one.
      if (intersects && intersectOverUnion >
MAX_OVERLAP) {
        if (potential.first <
trackedRecognition.detectionConfidence
                &&
trackedRecognition.trackedObject.getCurrentCorrela
tion() > MARGINAL_CORRELATION) {
          // If track for the existing object is
```

```
still going strong and the detection score was
          // good, reject this new object.
          potentialObject.stopTracking();
          return;
        } else {
          removeList.add(trackedRecognition);

          // Let the previously tracked object
with max intersection amount donate its color to
          // the new object.
          if (intersectOverUnion > maxIntersect) {
            maxIntersect = intersectOverUnion;
            recogToReplace = trackedRecognition;
          }
        }
      }
    }

    // If we're already tracking the max object
and no intersections were found to bump off,
    // pick the worst current tracked object to
remove, if it's also worse than this candidate
    // object.
    if (availableColors.isEmpty() &&
removeList.isEmpty()) {
      for (final TrackedRecognition candidate :
trackedObjects) {
        if (candidate.detectionConfidence <
potential.first) {
          if (recogToReplace == null
                  || candidate.detectionConfidence
< recogToReplace.detectionConfidence) {
            // Save it so that we use this color
for the new object.
            recogToReplace = candidate;
          }
        }
      }
      if (recogToReplace != null) {
        logger.v("Found non-intersecting object to
remove.");
        removeList.add(recogToReplace);
      } else {
        logger.v("No non-intersecting object found
to remove");
      }
    }
```

```
    // Remove everything that got intersected.
    for (final TrackedRecognition
trackedRecognition : removeList) {
      logger.v(
              "Removing tracked object %s with
detection confidence %.2f, correlation %.2f",
              trackedRecognition.trackedObject,

trackedRecognition.detectionConfidence,

trackedRecognition.trackedObject.getCurrentCorrela
tion());

trackedRecognition.trackedObject.stopTracking();
      trackedObjects.remove(trackedRecognition);
      if (trackedRecognition != recogToReplace) {

availableColors.add(trackedRecognition.color);
      }
    }

    if (recogToReplace == null &&
availableColors.isEmpty()) {
      logger.e("No room to track this object,
aborting.");
      potentialObject.stopTracking();
      return;
    }

    // Finally safe to say we can track this
object.
    logger.v(
            "Tracking object %s (%s) with
detection confidence %.2f at position %s",
            potentialObject,
            potential.second.getTitle(),
            potential.first,
            potential.second.getLocation());
    final TrackedRecognition trackedRecognition =
new TrackedRecognition();
    trackedRecognition.detectionConfidence =
potential.first;
    trackedRecognition.trackedObject =
potentialObject;
    trackedRecognition.title =
potential.second.getTitle();
```

```
    // Use the color from a replaced object before
taking one from the color queue.
    trackedRecognition.color =
            recogToReplace != null ?
recogToReplace.color : availableColors.poll();
    trackedObjects.add(trackedRecognition);
  }
}
```

7. **TextToSpeech**

```
public abstract class TextToSpeechActivity extends
CameraActivity implements
TextToSpeech.OnInitListener {
    private TextToSpeech textToSpeech;
    private String lastRecognizedClass="";

    @Override
    public void onInit(int status){
        int result =
textToSpeech.setLanguage(Locale.ENGLISH); //US
        if (result ==
TextToSpeech.LANG_MISSING_DATA
                || result ==
TextToSpeech.LANG_NOT_SUPPORTED) {
            //Log.e(Tag,"Text to speech error:
This Language is not supported");
        }
     else {
        Log.e("message","Text to speech:
Initilization Failed!");
    }
}

    @Override
    protected void onCreate(Bundle
savedInstanceState) {
        super.onCreate(savedInstanceState);
        textToSpeech = new TextToSpeech(this,
this);
    }

    protected void
speak(List<Classifier.Recognition> results, String
```

```
hasil) {
        if (!(results.isEmpty() ||
lastRecognizedClass.equals(results.get(0).getTitle
())))  {
            lastRecognizedClass = "tangga"+ hasil
;
            if (Build.VERSION.SDK_INT >=
Build.VERSION_CODES.LOLLIPOP) {

textToSpeech.speak(lastRecognizedClass,
TextToSpeech.QUEUE_FLUSH, null, null);
            } else {

textToSpeech.speak(lastRecognizedClass,
TextToSpeech.QUEUE_FLUSH, null);
            }
        }
    }

}
```

LEMBAR PERBAIKAN SKRIPSI

"SISTEM DETEKSI DAN ESTIMASI JARAK TANGGA SECARA REALTIME BERBASIS ANDROID UNTUK PENYANDANG TUNANETRA"

OLEH:

HERLINA ANWAR
D121171009

Skripsi ini telah dipertahankan pada Ujian Akhir Sarjana tanggal 21 Juli 2022.

Telah dilakukan perbaikan penulisan dan isi skripsi berdasarkan usulan dari penguji dan pembimbing skripsi.

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