iaz9ndorz

November 17, 2025

[7]:
```
!curl https://raw.githubusercontent.com/pytorch/xla/master/contrib/scripts/
  ↪env-setup.py -o pytorch-xla-env-setup.py
!python pytorch-xla-env-setup.py --version 2.1 --apt-packages libgoogleapi-dev␣
  ↪libgl1-mesa-glx
```

```
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100    14  100    14    0     0     30      0 --:--:-- --:--:-- --:--:--    30
  File "/content/pytorch-xla-env-setup.py", line 1
    404: Not Found
    ^^^

SyntaxError: illegal target for annotation
```

[ ]:
```python
# ======================================================================
# CELL 2: Imports (Versi Update)
# ======================================================================

import torch
import torch.nn as nn
import torch.optim as optim
from torch.utils.data import DataLoader, Dataset, random_split
import pandas as pd
import math
import matplotlib.pyplot as plt
import numpy as np
import time # <-- TAMBAHAN BARU DI SINI

# --- IMPORT UNTUK TPU (PyTorch/XLA) ---
import torch_xla
import torch_xla.core.xla_model as xm
import torch_xla.distributed.parallel_loader as pl
import torch_xla.runtime

# --- IMPORT UNTUK PROGRESS BAR ---
from tqdm.notebook import tqdm

print("Cell 2: Semua library berhasil di-import. (Termasuk 'time')")
```

A. Persiapan data. Jelaskan preprocessing yang diperlukan (tokenisasi/subword, max length, padding, train/val/test split, dsb.)

[4]:
```
# ======================================================================
# CELL 3: Definisi Persiapan Data
# ======================================================================

# --- Class Vocabulary ---
class Vocabulary:
    def __init__(self):
        # [PAD] = 0
        self.word2idx = {"[PAD]": 0, "[UNK]": 1, "[CLS]": 2}
        self.idx2word = {0: "[PAD]", 1: "[UNK]", 2: "[CLS]"}
        self.idx = 3
    def add_word(self, word):
        if word not in self.word2idx:
            self.word2idx[word] = self.idx
            self.idx2word[self.idx] = word
            self.idx += 1
    def __len__(self):
        return len(self.word2idx)

# --- Class Dataset ---
class SentimentDataset(Dataset):
    def __init__(self, data, vocab, max_len):
        self.data = data
        self.vocab = vocab
        self.max_len = max_len
    def __len__(self):
        return len(self.data)
    def __getitem__(self, idx):
        sentence, label = self.data[idx]
        tokens = ["[CLS]"] + str(sentence).split()
        token_ids = [self.vocab.word2idx.get(w, self.vocab.word2idx["[UNK]"])␣
 ↪for w in tokens]
        token_ids = token_ids[:self.max_len]
        return torch.tensor(token_ids), label # Perbaikan TypeError

# --- Fungsi Collate (Padding) ---
def collate_fn(batch):
    token_ids, labels = zip(*batch)
    max_len_in_batch = max(len(t) for t in token_ids)

    # [PAD] token adalah 0, jadi kita fill_value=0
    padded_tokens = torch.full((len(batch), max_len_in_batch),
                               fill_value=0, # Perbaikan: [PAD] adalah 0
                               dtype=torch.long)
    padding_mask = torch.zeros((len(batch), max_len_in_batch), dtype=torch.bool)

    for i, tokens in enumerate(token_ids):
        seq_len = len(tokens)
        padded_tokens[i, :seq_len] = tokens
        padding_mask[i, seq_len:] = True

    labels = torch.tensor(labels, dtype=torch.long)
    return padded_tokens, padding_mask, labels

# --- Fungsi Utama Prepare Data ---
def prepare_data():
    """Fungsi untuk load dan proses data, mengembalikan data loader."""

    file_path = '7-garudaindonesia_news_cleaned_simple.csv' # Pastikan nama␣
 ↪file BENAR
    try:
        df = pd.read_csv(file_path)
    except FileNotFoundError:
        xm.master_print(f"ERROR: File '7-garudaindonesia_news_cleaned_simple.
 ↪csv' tidak ditemukan.")
        return None

    # Preprocessing & Label Mapping
    df = df.dropna(subset=['konten_normalized', 'sentiment'])
    label_map = {'Positive': 1, 'Negative': 0}
    df['label'] = df['sentiment'].map(label_map)

    # PERBAIKAN 'nan'
    df = df.dropna(subset=['label'])
    df['label'] = df['label'].astype(int)

    data_tuples = list(zip(df['konten_normalized'], df['label']))

    xm.master_print(f"Total data yang akan dipakai: {len(data_tuples)} baris")
    if len(data_tuples) > 0:
        xm.master_print(f"Contoh data (setelah bersih): {data_tuples[0]}")
    else:
        xm.master_print("ERROR: Tidak ada data valid setelah mapping label.")
        return None

    # Build Vocab
    xm.master_print("Membangun vocabulary...")
    vocab = Vocabulary()
    for sentence, _ in data_tuples:
        for word in str(sentence).split():
            vocab.add_word(word)
    VOCAB_SIZE = len(vocab)
    lengths = [len(str(s).split()) for s, _ in data_tuples]
    MAX_LEN = int(np.percentile(lengths, 95))

    xm.master_print(f"Ukuran Vocabulary: {VOCAB_SIZE}")
    xm.master_print(f"MAX_LEN di-set ke: {MAX_LEN} (95th percentile)")

    # Train/Val Split
    dataset = SentimentDataset(data_tuples, vocab, MAX_LEN)
    train_size = int(0.8 * len(dataset))
    val_size = len(dataset) - train_size
    train_dataset, val_dataset = random_split(dataset, [train_size, val_size])

    xm.master_print(f"Data latih: {len(train_dataset)}, Data validasi:␣
 ↪{len(val_dataset)}")

    # KEMBALIKAN SEMUA YANG DIBUTUHKAN
    return train_dataset, val_dataset, vocab, MAX_LEN, VOCAB_SIZE, collate_fn

print("Cell 3 (Persiapan Data) siap.")
```

```
Cell 3 (Persiapan Data) siap.
```

B. Model awal. Jelaskan desain arsitektur Transformer (embedding dim, positional encoding, #heads, #layers, feed-forward dim, dropout, classifier head), inisialisasi, optimizer, loss;

a) Latih model awal dengan konfigurasi default (mis. lr=1e-4, batch=32, epochs=10) dan laporkan sebagai performance awal.

b) Simpan loss & metric (train & val) per epoch dan tampilkan grafik loss/accuracy training vs validation

c) Jelaskan apakah model mengalami underfit/baik/overfit pada konfigurasi awal ini.

[5]:

```
# ========================================================================
# CELL 4: Definisi Arsitektur Model
# ========================================================================

class PositionalEncoding(nn.Module):
    def __init__(self, d_model, dropout=0.1, max_len=5000):
        super(PositionalEncoding, self).__init__()
        self.dropout = nn.Dropout(p=dropout)
        pe = torch.zeros(max_len, d_model)
        position = torch.arange(0, max_len, dtype=torch.float).unsqueeze(1)
        div_term = torch.exp(torch.arange(0, d_model, 2).float() * (-math.
 ↪log(10000.0) / d_model))
        pe[:, 0::2] = torch.sin(position * div_term)
        pe[:, 1::2] = torch.cos(position * div_term)
        pe = pe.unsqueeze(0)
        self.register_buffer('pe', pe)
    def forward(self, x):
        x = x + self.pe[:, :x.size(1), :]
        return self.dropout(x)

class MultiHeadAttention(nn.Module):
    def __init__(self, d_model, n_heads, dropout=0.1):
        super(MultiHeadAttention, self).__init__()
        assert d_model % n_heads == 0, "d_model harus bisa dibagi n_heads"
        self.d_model = d_model
        self.n_heads = n_heads
        self.d_k = d_model // n_heads
        self.W_q = nn.Linear(d_model, d_model)
        self.W_k = nn.Linear(d_model, d_model)
        self.W_v = nn.Linear(d_model, d_model)
        self.W_o = nn.Linear(d_model, d_model)
        self.dropout = nn.Dropout(dropout)
        self.scale = torch.sqrt(torch.FloatTensor([self.d_k]))
    def forward(self, query, key, value, mask=None):
        batch_size = query.size(0)
        Q = self.W_q(query)
        K = self.W_k(key)
        V = self.W_v(value)
        Q = Q.view(batch_size, -1, self.n_heads, self.d_k).transpose(1, 2)
        K = K.view(batch_size, -1, self.n_heads, self.d_k).transpose(1, 2)
        V = V.view(batch_size, -1, self.n_heads, self.d_k).transpose(1, 2)
        # Pindahkan scale ke device yang benar saat forward pass
        scores = torch.matmul(Q, K.transpose(-2, -1)) / self.scale.to(query.
 ↪device)
        if mask is not None:
            mask = mask.unsqueeze(1).unsqueeze(2)
            scores = scores.masked_fill(mask == True, -1e9)
        attention = torch.softmax(scores, dim=-1)
        attention = self.dropout(attention)
        context = torch.matmul(attention, V)
        context = context.transpose(1, 2).contiguous()
        context = context.view(batch_size, -1, self.d_model)
        output = self.W_o(context)
        return output

class PositionwiseFeedForward(nn.Module):
    def __init__(self, d_model, ff_dim, dropout=0.1):
        super(PositionwiseFeedForward, self).__init__()
        self.linear1 = nn.Linear(d_model, ff_dim)
        self.linear2 = nn.Linear(ff_dim, d_model)
        self.relu = nn.ReLU()
```

```python
        self.dropout = nn.Dropout(dropout)
    def forward(self, x):
        return self.dropout(self.linear2(self.relu(self.linear1(x))))

class EncoderLayer(nn.Module):
    def __init__(self, d_model, n_heads, ff_dim, dropout=0.1):
        super(EncoderLayer, self).__init__()
        self.attn = MultiHeadAttention(d_model, n_heads, dropout)
        self.ffn = PositionwiseFeedForward(d_model, ff_dim, dropout)
        self.norm1 = nn.LayerNorm(d_model)
        self.norm2 = nn.LayerNorm(d_model)
        self.dropout1 = nn.Dropout(dropout)
        self.dropout2 = nn.Dropout(dropout)
    def forward(self, x, mask):
        attn_output = self.attn(x, x, x, mask)
        x = self.norm1(x + self.dropout1(attn_output))
        ffn_output = self.ffn(x)
        x = self.norm2(x + self.dropout2(ffn_output))
        return x

class SentimentClassifier(nn.Module):
    def __init__(self, vocab_size, embed_dim, n_heads, num_layers, ff_dim, num_classes=2, dropout=0.1, max_len=5000):
        super(SentimentClassifier, self).__init__()
        self.embedding = nn.Embedding(vocab_size, embed_dim)
        self.pos_encoder = PositionalEncoding(embed_dim, dropout, max_len)
        self.encoder_layers = nn.ModuleList([
            EncoderLayer(embed_dim, n_heads, ff_dim, dropout)
            for _ in range(num_layers)
        ])
        self.dropout = nn.Dropout(dropout)
        self.classifier_head = nn.Linear(embed_dim, num_classes)
    def forward(self, src, src_mask):
        embedded = self.embedding(src)
        embedded = self.pos_encoder(embedded)
        output = embedded
        for layer in self.encoder_layers:
            output = layer(output, src_mask)
        cls_output = output[:, 0, :]
        cls_output = self.dropout(cls_output)
        logits = self.classifier_head(cls_output)
        return logits

print("Cell 4 (Arsitektur Model) siap.")
```

```
Cell 4 (Arsitektur Model) siap.
```

[6]:

```
# ======================================================================
# CELL 5: Definisi Fungsi Training & Validasi (FIXED 100%)
# ======================================================================

def train_epoch(model, loader, optimizer, criterion, device, num_batches,␣
 ↪epoch_num, total_epochs):
    model.train()
    total_loss = 0
    total_correct = 0
    total_samples = 0

    pbar = None
    # --- PERBAIKAN DI SINI: Pake 'runtime.global_ordinal()' ---
    if torch_xla.runtime.global_ordinal() == 0:
        pbar = tqdm(total=num_batches,
                    desc=f'Epoch {epoch_num}/{total_epochs} Train',
                    leave=False)

    for tokens, mask, labels in loader:
        optimizer.zero_grad()
        logits = model(tokens, mask)
        loss = criterion(logits, labels)
        loss.backward()
        xm.optimizer_step(optimizer, barrier=True)

        total_loss += loss.item() * tokens.size(0)
        preds = logits.argmax(dim=1)
        total_correct += (preds == labels).sum().item()
        total_samples += tokens.size(0)

        # --- PERBAIKAN DI SINI ---
        if torch_xla.runtime.global_ordinal() == 0:
            pbar.update(1)

    # --- PERBAIKAN DI SINI ---
    if torch_xla.runtime.global_ordinal() == 0:
        pbar.close()

    if total_samples == 0: return 0.0, 0.0
    avg_loss = total_loss / total_samples
    avg_acc = total_correct / total_samples
    return avg_loss, avg_acc

def validate_epoch(model, loader, criterion, device, num_batches, epoch_num,␣
 ↪total_epochs):
    model.eval()
    total_loss = 0
    total_correct = 0
    total_samples = 0

    pbar = None
    # --- PERBAIKAN DI SINI ---
    if torch_xla.runtime.global_ordinal() == 0:
        pbar = tqdm(total=num_batches,
                    desc=f'Epoch {epoch_num}/{total_epochs} Val  ',
                    leave=False)

    with torch.no_grad():
        for tokens, mask, labels in loader:
            logits = model(tokens, mask)
            loss = criterion(logits, labels)

            total_loss += loss.item() * tokens.size(0)
            preds = logits.argmax(dim=1)
            total_correct += (preds == labels).sum().item()
            total_samples += tokens.size(0)

            # --- PERBAIKAN DI SINI ---
            if torch_xla.runtime.global_ordinal() == 0:
                pbar.update(1)

    # --- PERBAIKAN DI SINI ---
    if torch_xla.runtime.global_ordinal() == 0:
        pbar.close()

    if total_samples == 0: return 0.0, 0.0
    avg_loss = total_loss / total_samples
    avg_acc = total_correct / total_samples
    return avg_loss, avg_acc

print("Cell 5 (Fungsi Train/Val) siap. (v2.8.0 fix, take 4)")
```

```
Cell 5 (Fungsi Train/Val) siap. (v2.8.0 fix, take 4)
```

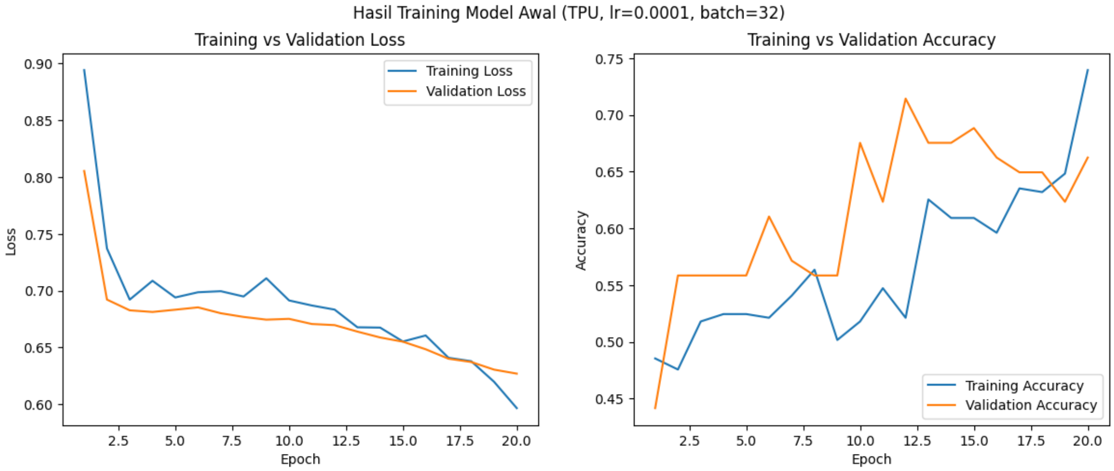
[7]:

```
# ======================================================================
# CELL 6: Main Training (Eksekusi) (FIXED 100%)
# ======================================================================

def main_training():
    # --- Konfigurasi ---
    EMBED_DIM = 64
    N_HEADS = 4
    NUM_LAYERS = 2
    FF_DIM = 128
    DROPOUT = 0.1
    NUM_CLASSES = 2
    LEARNING_RATE = 1e-4
    BATCH_SIZE = 32
    EPOCHS = 20

    # --- PENGATURAN TPU ---
    device = torch_xla.device()
    xm.master_print(f"Using device: {device}")

    # --- Siapkan data ---
    data_prep_results = prepare_data()
    if data_prep_results is None:
        xm.master_print("Gagal memproses data. Training dibatalkan.")
        return

    train_dataset, val_dataset, vocab, MAX_LEN, VOCAB_SIZE, collate_fn_from_prep = data_prep_results

    # --- Buat DataLoaders ---
    train_loader_base = DataLoader(train_dataset, batch_size=BATCH_SIZE, shuffle=True, collate_fn=collate_fn_from_prep, num_workers=4)
    val_loader_base = DataLoader(val_dataset, batch_size=BATCH_SIZE, collate_fn=collate_fn_from_prep, num_workers=4)
    train_loader = pl.MpDeviceLoader(train_loader_base, device)
    val_loader = pl.MpDeviceLoader(val_loader_base, device)

    # --- Inisialisasi Model ---
    model = SentimentClassifier(
        vocab_size=VOCAB_SIZE,
        embed_dim=EMBED_DIM,
        n_heads=N_HEADS,
        num_layers=NUM_LAYERS,
        ff_dim=FF_DIM,
        num_classes=NUM_CLASSES,
        dropout=DROPOUT,
        max_len=MAX_LEN + 1
    ).to(device)

    # --- Optimizer dan Loss ---
    optimizer = optim.Adam(model.parameters(), lr=LEARNING_RATE)
    criterion = nn.CrossEntropyLoss()

    # --- Training Loop ---
    history = {
        'train_loss': [], 'train_acc': [],
        'val_loss': [], 'val_acc': []
    }

    xm.master_print("Mulai training model awal (dengan data CSV di TPU)...")

    for epoch in range(EPOCHS):
        num_train_batches = len(train_loader_base)
        num_val_batches = len(val_loader_base)

        train_loss, train_acc = train_epoch(
            model, train_loader, optimizer, criterion, device,
            num_train_batches, epoch + 1, EPOCHS
        )
        val_loss, val_acc = validate_epoch(
            model, val_loader, criterion, device,
            num_val_batches, epoch + 1, EPOCHS
        )

        history['train_loss'].append(train_loss)
        history['train_acc'].append(train_acc)
        history['val_loss'].append(val_loss)
        history['val_acc'].append(val_acc)

        xm.master_print(f"Epoch {epoch+1}/{EPOCHS} | "
                      f"Train Loss: {train_loss:.4f} | Train Acc: {train_acc:.
↪4f} | "
                      f"Val Loss: {val_loss:.4f} | Val Acc: {val_acc:.4f}")

    xm.master_print("\n--- Performance Awal (Epoch Terakhir) ---")
    xm.master_print(f"Final Train Loss: {history['train_loss'][-1]:.4f}")
    xm.master_print(f"Final Train Acc: {history['train_acc'][-1]:.4f}")
    xm.master_print(f"Final Val Loss: {history['val_loss'][-1]:.4f}")
    xm.master_print(f"Final Val Acc: {history['val_acc'][-1]:.4f}")

    # --- Tampilkan Grafik ---
    # --- PERBAIKAN DI SINI ---
    if torch_xla.runtime.global_ordinal() == 0:
        xm.master_print("\nMembuat grafik...")
        epochs_range = range(1, EPOCHS + 1)
        plt.figure(figsize=(14, 5))

        plt.subplot(1, 2, 1)
        plt.plot(epochs_range, history['train_loss'], label='Training Loss')
        plt.plot(epochs_range, history['val_loss'], label='Validation Loss')
        plt.legend(loc='upper right')
        plt.title('Training vs Validation Loss')
        plt.xlabel('Epoch')
        plt.ylabel('Loss')
        plt.subplot(1, 2, 2)
        plt.plot(epochs_range, history['train_acc'], label='Training Accuracy')
        plt.plot(epochs_range, history['val_acc'], label='Validation Accuracy')
        plt.legend(loc='lower right')
        plt.title('Training vs Validation Accuracy')
        plt.xlabel('Epoch')
        plt.ylabel('Accuracy')

        plt.suptitle(f'Hasil Training Model Awal (TPU, lr={LEARNING_RATE},␣
 ↪batch={BATCH_SIZE})')
        plt.savefig('training_plots_tpu.png')
        plt.show()
        xm.master_print("Grafik disimpan sebagai 'training_plots_tpu.png'")


# --- Jalankan Training ---
if __name__ == '__main__':
    main_training()
```

```
Using device: xla:0
Total data yang akan dipakai: 384 baris
Contoh data (setelah bersih): ('jakarta ketua komisi v dpr lasarus mengatakan
mendalami laporan dugaan adanya mafia jual beli jam penerbangan di industri
aviasi tanah air dalam rapat mendatang dengan kementerian perhubungan serta
maskapai pernyataan tersebut menanggapi kabar dugaan adanya mafia jual beli jam
penerbangan kecurigaan adanya mafia ini berawal dari tidak adanya penerbangan
garuda indonesia di jam jam favorit begitu juga dengan anak usaha garuda
indonesia citilink indonesia iya kita coba tanya kita bahas lah kalau benar
nanti kita dalami ini kan informasi yang bagus katanya kepada voi senin
september meski begitu lasarus mengaku maskapai garuda indonesia selama ini juga
tidak pernah mengeluhkan terkait jam penerbangan atau slot time yang diberikan
kepada maskapai tersebut adapun slot time adalah jadwal resmi yang diberikan
otoritas bandara kepada maskapai untuk melakukan take off atau landingdi bandara
tertentu makanya saya masih mau cek dulu omongan ini apakah berangkat dari data
karena garuda sendiri enggak pernah ngeluh sama kita ucapnya terkait dengan slot
time sambung lasarus sudah diatur oleh otoritas yang berwenang dalam hal ini
direktorat jenderal perhubungan udara kementerian perhubungan jumlah slot time
yang didapat juga berbeda beda tergantung dari berapa armada yang dimiliki
maskapai tersebut biasanya kan sudah diatur misalnya begini pesawat itu kan
tidak semua maskapai jumlah pesawatnya sama untuk dibagi rata kan tidak mungkin
jelasnya sebelumnya anggota komisi vi dpr fraksi pdi perjuangan mufti anam
mengungkap dugaan adanya mafia jual beli jam penerbangan dalam bisnis aviasi di
indonesia bahkan sambung mufti jam penerbangan bisa diperjualbelikan dengan
harga yang cukup fantastis mencapai miliaran rupiah ini betul enggak ada mafia
soal jam terbang ini katanya harganya miliaran rupiah kalau ada kami meminta
penegak hukum mengusut soal hal ini ujarnya rapat dengar pendapat antara komisi
```

```
vi dan garuda indonesia injourney airports dan ias senin september kecurigaan
adanya mafia jual beli jam penerbangan ini sambung mufti berawal dari tidak
adanya penerbangan garuda indonesia di jam jam favorit begitu juga dengan anak
usaha garuda indonesia citilink indonesia saya sempat mengobrol dengan teman
teman komisi v katanya jam jam penerbangan diperjual belikan betul enggak pak
kami meminta bapak jawab di tempat jangan takut takut pak kita akan bantu bapak
bagaimana garuda bisa punya jam idle begitu tuturnya sekadar informasi jam idle
penerbangan biasanya merujuk pada waktu pesawat tidak beroperasi atau menunggu
di darat antara penerbangan kondisi ini lebih sering disebut trunaround atau
waktu berhenti terbang karena ternyata jam jam idle itu dikuasai oleh
penerbangan swasta bahkan jam jam tertentu karena idle banget itu ada
penerbangan yang jaraknya hanya menit dan kalau kosong itu dijadikan hanya satu
penerbangan ucapnya mufti bilang akibat penggabungan itu banyak penumpang
pesawat yang terdampak delay atau penundaan penerbangan akhirnya berdampak
kepada penumpang harus delay dan sebagainya katanya', 0)
Membangun vocabulary…
Ukuran Vocabulary: 8052
MAX_LEN di-set ke: 646 (95th percentile)
Data latih: 307, Data validasi: 77
Mulai training model awal (dengan data CSV di TPU)…

Epoch 1/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

/usr/local/lib/python3.12/dist-packages/jax/_src/cloud_tpu_init.py:86:
UserWarning: Transparent hugepages are not enabled. TPU runtime startup and
shutdown time should be significantly improved on TPU v5e and newer. If not
already set, you may need to enable transparent hugepages in your VM image (sudo
sh -c "echo always > /sys/kernel/mm/transparent_hugepage/enabled")
  warnings.warn(

Epoch 1/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 1/20 | Train Loss: 0.8943 | Train Acc: 0.4853 | Val Loss: 0.8054 | Val
Acc: 0.4416

Epoch 2/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 2/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 2/20 | Train Loss: 0.7371 | Train Acc: 0.4756 | Val Loss: 0.6921 | Val
Acc: 0.5584

Epoch 3/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 3/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 3/20 | Train Loss: 0.6921 | Train Acc: 0.5179 | Val Loss: 0.6826 | Val
Acc: 0.5584

Epoch 4/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 4/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 4/20 | Train Loss: 0.7087 | Train Acc: 0.5244 | Val Loss: 0.6812 | Val
Acc: 0.5584

Epoch 5/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 5/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 5/20 | Train Loss: 0.6940 | Train Acc: 0.5244 | Val Loss: 0.6832 | Val
Acc: 0.5584

Epoch 6/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 6/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 6/20 | Train Loss: 0.6986 | Train Acc: 0.5212 | Val Loss: 0.6853 | Val
Acc: 0.6104

Epoch 7/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 7/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 7/20 | Train Loss: 0.6995 | Train Acc: 0.5407 | Val Loss: 0.6801 | Val
Acc: 0.5714

Epoch 8/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 8/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 8/20 | Train Loss: 0.6948 | Train Acc: 0.5635 | Val Loss: 0.6768 | Val
Acc: 0.5584

Epoch 9/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 9/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 9/20 | Train Loss: 0.7109 | Train Acc: 0.5016 | Val Loss: 0.6744 | Val
Acc: 0.5584

Epoch 10/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 10/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 10/20 | Train Loss: 0.6914 | Train Acc: 0.5179 | Val Loss: 0.6751 | Val
Acc: 0.6753

Epoch 11/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 11/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 11/20 | Train Loss: 0.6869 | Train Acc: 0.5472 | Val Loss: 0.6706 | Val
Acc: 0.6234

Epoch 12/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 12/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 12/20 | Train Loss: 0.6833 | Train Acc: 0.5212 | Val Loss: 0.6696 | Val
Acc: 0.7143

Epoch 13/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 13/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 13/20 | Train Loss: 0.6677 | Train Acc: 0.6254 | Val Loss: 0.6639 | Val
Acc: 0.6753

Epoch 14/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 14/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 14/20 | Train Loss: 0.6674 | Train Acc: 0.6091 | Val Loss: 0.6587 | Val
Acc: 0.6753

Epoch 15/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 15/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 15/20 | Train Loss: 0.6552 | Train Acc: 0.6091 | Val Loss: 0.6550 | Val
Acc: 0.6883

Epoch 16/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 16/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 16/20 | Train Loss: 0.6605 | Train Acc: 0.5961 | Val Loss: 0.6484 | Val
Acc: 0.6623

Epoch 17/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 17/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 17/20 | Train Loss: 0.6409 | Train Acc: 0.6352 | Val Loss: 0.6400 | Val
Acc: 0.6494

Epoch 18/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 18/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 18/20 | Train Loss: 0.6378 | Train Acc: 0.6319 | Val Loss: 0.6371 | Val
Acc: 0.6494

Epoch 19/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 19/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 19/20 | Train Loss: 0.6198 | Train Acc: 0.6482 | Val Loss: 0.6304 | Val
Acc: 0.6234

Epoch 20/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 20/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 20/20 | Train Loss: 0.5965 | Train Acc: 0.7394 | Val Loss: 0.6269 | Val
Acc: 0.6623

--- Performance Awal (Epoch Terakhir) ---
Final Train Loss: 0.5965
Final Train Acc: 0.7394
Final Val Loss: 0.6269
Final Val Acc: 0.6623
```

```
Membuat grafik…
```



```
Grafik disimpan sebagai 'training_plots_tpu.png'
```

C. Eksperimen untuk meningkatkan performa. Rancang sejumlah rangkaian eksperimen sistematis:

a) Ubah epoch misal sampai 50 dan amati apakah terjadi overfitting (buktikan dengan grafik dan metrik)

b) Lakukan variasi hyperparameter arsitektur, minimal terdapat satu kali perubahan untuk setiap parameter: misal adalah jumlah head (mis. 2,4,8), jumlah encoder layers (mis. 1,2,4), embed_dim (64,128,256), dropout (0.1–0.5).

[9]:
```python
# ======================================================================
# CELL 7: Fungsi Plotting (Baru)
# ======================================================================

def plot_history(history, title):
    """Fungsi helper untuk nge-plot loss dan accuracy."""

    # Fungsi ini HANYA jalan di master process
    if torch_xla.runtime.global_ordinal() != 0:
        return

    epochs_range = range(1, len(history['train_loss']) + 1)

    plt.figure(figsize=(14, 5))

    # Plot Loss
    plt.subplot(1, 2, 1)
    plt.plot(epochs_range, history['train_loss'], label='Training Loss')
    plt.plot(epochs_range, history['val_loss'], label='Validation Loss')
    plt.legend(loc='upper right')
    plt.title('Training vs Validation Loss')
    plt.xlabel('Epoch')
    plt.ylabel('Loss')

    # Plot Accuracy
    plt.subplot(1, 2, 2)
    plt.plot(epochs_range, history['train_acc'], label='Training Accuracy')
    plt.plot(epochs_range, history['val_acc'], label='Validation Accuracy')
    plt.legend(loc='lower right')
    plt.title('Training vs Validation Accuracy')
    plt.xlabel('Epoch')
    plt.ylabel('Accuracy')

    plt.suptitle(title)

    # Ganti karakter ilegal di nama file
    filename = title.lower().replace(' ', '_').replace('=', '').replace('.',␣
  ↪'').replace(':', '') + '.png'
    plt.savefig(filename)
    plt.show()

    xm.master_print(f"Grafik disimpan sebagai: {filename}")

print("Cell 7 (Fungsi Plotting) siap.")
```

```
Cell 7 (Fungsi Plotting) siap.
```

[11]:

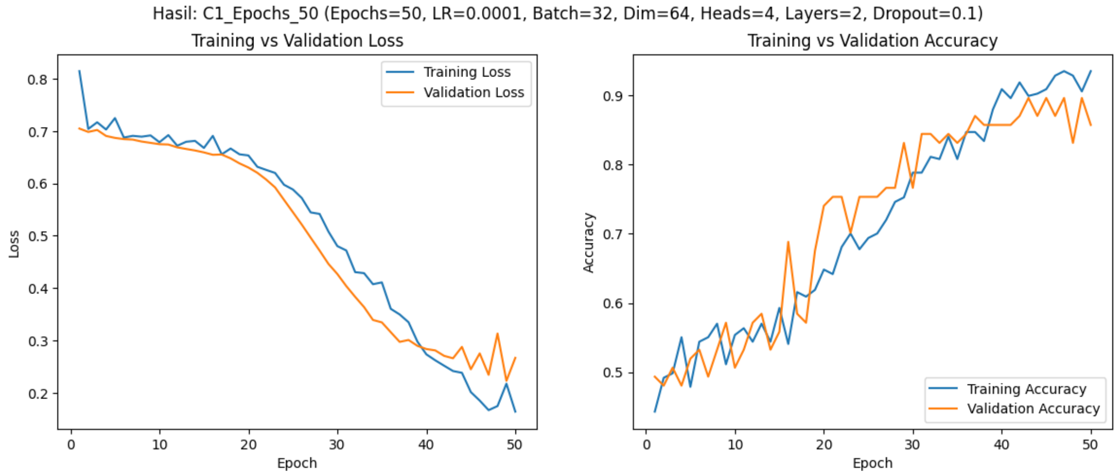
```
# ======================================================================
# CELL 8: Bagian C - Eksperimen Hyperparameter (Baru)
# ======================================================================

def run_experiment(config, data_prep_results):
    """
    Fungsi ini menjalankan satu eksperimen penuh berdasarkan 'config'.
    """

    xm.master_print("\n" + "="*50)
    xm.master_print(f"MULAI EKSPERIMEN: {config['name']}")
    xm.master_print(f"Konfigurasi: {config}")
    xm.master_print("="*50)

    # --- 1. Ambil data yang sudah disiapkan ---
    train_dataset, val_dataset, vocab, MAX_LEN, VOCAB_SIZE,␣
  ↪collate_fn_from_prep = data_prep_results

    # --- 2. Dapatkan device ---
    device = torch_xla.device()

    # --- 3. Buat DataLoaders ---
    train_loader_base = DataLoader(train_dataset,␣
↪batch_size=config['batch_size'], shuffle=True,␣
↪collate_fn=collate_fn_from_prep, num_workers=4)
    val_loader_base = DataLoader(val_dataset, batch_size=config['batch_size'],␣
↪collate_fn=collate_fn_from_prep, num_workers=4)
    train_loader = pl.MpDeviceLoader(train_loader_base, device)
    val_loader = pl.MpDeviceLoader(val_loader_base, device)

    # --- 4. Inisialisasi Model (sesuai config) ---
    # Memanggil class dari Cell 4
    model = SentimentClassifier(
        vocab_size=VOCAB_SIZE,
        embed_dim=config['embed_dim'],
        n_heads=config['n_heads'],
        num_layers=config['num_layers'],
        ff_dim=config['ff_dim'], # Kita buat ff_dim = 2x embed_dim
        num_classes=2,
        dropout=config['dropout'],
        max_len=MAX_LEN + 1
    ).to(device)

    # --- 5. Optimizer dan Loss ---
    # Tambahkan 'weight_decay' (L2 regularization)
    optimizer = optim.Adam(model.parameters(),
                           lr=config['lr'],
                           weight_decay=config.get('weight_decay', 0.0)) #␣
↪default 0
    criterion = nn.CrossEntropyLoss()

    # --- 6. Training Loop ---
    history = { 'train_loss': [], 'train_acc': [], 'val_loss': [], 'val_acc':␣
↪[] }

    start_time = time.time() # Catat waktu mulai

    for epoch in range(config['epochs']):
        num_train_batches = len(train_loader_base)
        num_val_batches = len(val_loader_base)

        # Memanggil fungsi dari Cell 5
        train_loss, train_acc = train_epoch(
            model, train_loader, optimizer, criterion, device,
            num_train_batches, epoch + 1, config['epochs']
        )
        val_loss, val_acc = validate_epoch(
            model, val_loader, criterion, device,
            num_val_batches, epoch + 1, config['epochs']
        )

        history['train_loss'].append(train_loss)
        history['train_acc'].append(train_acc)
        history['val_loss'].append(val_loss)
        history['val_acc'].append(val_acc)

        # Print summary per epoch
        xm.master_print(f"Epoch {epoch+1}/{config['epochs']} | "
                      f"Train Loss: {train_loss:.4f} | Train Acc: {train_acc:.
↪4f} | "
                      f"Val Loss: {val_loss:.4f} | Val Acc: {val_acc:.4f}")

    end_time = time.time()
    total_time_sec = end_time - start_time

    # --- 7. Laporan Hasil ---
    xm.master_print(f"\n--- Hasil Eksperimen: {config['name']} ---")
    xm.master_print(f"Waktu Training Total: {total_time_sec:.2f} detik")
    xm.master_print(f"Final Train Loss: {history['train_loss'][-1]:.4f}")
    xm.master_print(f"Final Train Acc: {history['train_acc'][-1]:.4f}")
    xm.master_print(f"Final Val Loss: {history['val_loss'][-1]:.4f}")
    xm.master_print(f"Final Val Acc: {history['val_acc'][-1]:.4f}")

    # --- 8. Plot Hasil ---
    # Memanggil fungsi dari Cell 7
    plot_title = f"Hasil: {config['name']} (Epochs={config['epochs']},␣
↪LR={config['lr']}, Batch={config['batch_size']}, Dim={config['embed_dim']},␣
↪Heads={config['n_heads']}, Layers={config['num_layers']},␣
↪Dropout={config['dropout']})"
    plot_history(history, plot_title)

    xm.master_print("="*50)

    # Kembalikan metrik untuk analisis nanti
    return {
        "name": config['name'],
        "time_sec": total_time_sec,
        "history": history,
        "config": config,
        "final_val_acc": history['val_acc'][-1]
    }

# ==================================================
# --- INI ADALAH EKSEKUSI UTAMA BAGIAN C ---
# ================================================
if __name__ == '__main__':
    # 1. Siapkan data SATU KALI SAJA
    xm.master_print("Menyiapkan data satu kali untuk semua eksperimen...")
    # 'prepare_data' dipanggil lagi di sini, tapi datanya udah di-cache
    # atau bisa juga kita panggil di cell terpisah.
    # Untuk amannya, kita panggil lagi.
    data_prep_results = prepare_data()

    if data_prep_results:
        # 2. Definisikan parameter dasar
        # Ini adalah konfigurasi dari run "Good Fit" kamu sebelumnya (Bagian B)
        BASE_CONFIG = {
            'lr': 1e-4,
            'batch_size': 32,
            'embed_dim': 64,
            'n_heads': 4,
            'num_layers': 2,
            'ff_dim': 128, # akan di-override oleh embed_dim * 2
            'dropout': 0.1,
            'epochs': 20, # default 20
            'weight_decay': 0.0
        }

        # 3. Definisikan list eksperimen untuk Bagian C
        experiments_c = [
            # C.1: Ubah epoch misal sampai 50
            {**BASE_CONFIG, 'name': 'C1_Epochs_50', 'epochs': 50},

            # C.2: Variasi #heads
            {**BASE_CONFIG, 'name': 'C2_Heads_2', 'n_heads': 2},
            {**BASE_CONFIG, 'name': 'C2_Heads_8', 'n_heads': 8},

            # C.2: Variasi #layers
            {**BASE_CONFIG, 'name': 'C2_Layers_1', 'num_layers': 1},
            {**BASE_CONFIG, 'name': 'C2_Layers_4', 'num_layers': 4},

            # C.2: Variasi embed_dim
            {**BASE_CONFIG, 'name': 'C2_Embed_128', 'embed_dim': 128, 'ff_dim':␣
 ↪256},
            {**BASE_CONFIG, 'name': 'C2_Embed_256', 'embed_dim': 256, 'ff_dim':␣
 ↪512},

            # C.2: Variasi dropout
            {**BASE_CONFIG, 'name': 'C2_Dropout_0.3', 'dropout': 0.3},
            {**BASE_CONFIG, 'name': 'C2_Dropout_0.5', 'dropout': 0.5},
```

```python
        ]

        # 4. Jalankan semua eksperimen
        results_c = []
        for config in experiments_c:
            config['ff_dim'] = config['embed_dim'] * 2

            if config['embed_dim'] % config['n_heads'] != 0:
                xm.master_print(f"Skipping config: {config['name']} karena embed_dim {config['embed_dim']} tidak bisa dibagi n_heads {config['n_heads']}")
                continue

            result = run_experiment(config, data_prep_results)
            results_c.append(result)

        # 5. Tampilkan ringkasan Bagian C
        if torch_xla.runtime.global_ordinal() == 0:
            xm.master_print("\n\n" + "="*70)
            xm.master_print("RINGKASAN EKSPERIMEN BAGIAN C")
            xm.master_print("="*70)
            xm.master_print(f"{'Nama Eksperimen':<25} | {'Waktu (detik)':<15} | {'Val Acc Akhir':<15}")
            xm.master_print("-"*70)
            for res in results_c:
                xm.master_print(f"{res['name']:<25} | {res['time_sec']:<15.2f} | {res['final_val_acc']:<15.4f}")

    else:
        xm.master_print("Gagal menyiapkan data. Eksperimen dibatalkan.")
```

```
Menyiapkan data satu kali untuk semua eksperimen…
Total data yang akan dipakai: 384 baris
Contoh data (setelah bersih): ('jakarta ketua komisi v dpr lasarus mengatakan
mendalami laporan dugaan adanya mafia jual beli jam penerbangan di industri
aviasi tanah air dalam rapat mendatang dengan kementerian perhubungan serta
maskapai pernyataan tersebut menanggapi kabar dugaan adanya mafia jual beli jam
penerbangan kecurigaan adanya mafia ini berawal dari tidak adanya penerbangan
garuda indonesia di jam jam favorit begitu juga dengan anak usaha garuda
indonesia citilink indonesia iya kita coba tanya kita bahas lah kalau benar
nanti kita dalami ini kan informasi yang bagus katanya kepada voi senin
september meski begitu lasarus mengaku maskapai garuda indonesia selama ini juga
tidak pernah mengeluhkan terkait jam penerbangan atau slot time yang diberikan
kepada maskapai tersebut adapun slot time adalah jadwal resmi yang diberikan
otoritas bandara kepada maskapai untuk melakukan take off atau landingdi bandara
tertentu makanya saya masih mau cek dulu omongan ini apakah berangkat dari data
karena garuda sendiri enggak pernah ngeluh sama kita ucapnya terkait dengan slot
time sambung lasarus sudah diatur oleh otoritas yang berwenang dalam hal ini
direktorat jenderal perhubungan udara kementerian perhubungan jumlah slot time
yang didapat juga berbeda beda tergantung dari berapa armada yang dimiliki
maskapai tersebut biasanya kan sudah diatur misalnya begini pesawat itu kan
tidak semua maskapai jumlah pesawatnya sama untuk dibagi rata kan tidak mungkin
jelasnya sebelumnya anggota komisi vi dpr fraksi pdi perjuangan mufti anam
mengungkap dugaan adanya mafia jual beli jam penerbangan dalam bisnis aviasi di
indonesia bahkan sambung mufti jam penerbangan bisa diperjualbelikan dengan
harga yang cukup fantastis mencapai miliaran rupiah ini betul enggak ada mafia
soal jam terbang ini katanya harganya miliaran rupiah kalau ada kami meminta
penegak hukum mengusut soal hal ini ujarnya rapat dengar pendapat antara komisi
vi dan garuda indonesia injourney airports dan ias senin september kecurigaan
adanya mafia jual beli jam penerbangan ini sambung mufti berawal dari tidak
adanya penerbangan garuda indonesia di jam jam favorit begitu juga dengan anak
usaha garuda indonesia citilink indonesia saya sempat mengobrol dengan teman
teman komisi v katanya jam jam penerbangan diperjual belikan betul enggak pak
kami meminta bapak jawab di tempat jangan takut takut pak kita akan bantu bapak
bagaimana garuda bisa punya jam idle begitu tuturnya sekadar informasi jam idle
penerbangan biasanya merujuk pada waktu pesawat tidak beroperasi atau menunggu
di darat antara penerbangan kondisi ini lebih sering disebut trunaround atau
waktu berhenti terbang karena ternyata jam jam idle itu dikuasai oleh
penerbangan swasta bahkan jam jam tertentu karena idle banget itu ada
penerbangan yang jaraknya hanya menit dan kalau kosong itu dijadikan hanya satu
penerbangan ucapnya mufti bilang akibat penggabungan itu banyak penumpang
pesawat yang terdampak delay atau penundaan penerbangan akhirnya berdampak
kepada penumpang harus delay dan sebagainya katanya', 0)
Membangun vocabulary…
Ukuran Vocabulary: 8052
MAX_LEN di-set ke: 646 (95th percentile)
Data latih: 307, Data validasi: 77

==================================================
MULAI EKSPERIMEN: C1_Epochs_50
Konfigurasi: {'lr': 0.0001, 'batch_size': 32, 'embed_dim': 64, 'n_heads': 4,
'num_layers': 2, 'ff_dim': 128, 'dropout': 0.1, 'epochs': 50, 'weight_decay':
0.0, 'name': 'C1_Epochs_50'}
==================================================

Epoch 1/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 1/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 1/50 | Train Loss: 0.8147 | Train Acc: 0.4430 | Val Loss: 0.7049 | Val
Acc: 0.4935

Epoch 2/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 2/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 2/50 | Train Loss: 0.7042 | Train Acc: 0.4919 | Val Loss: 0.6985 | Val
Acc: 0.4805
```

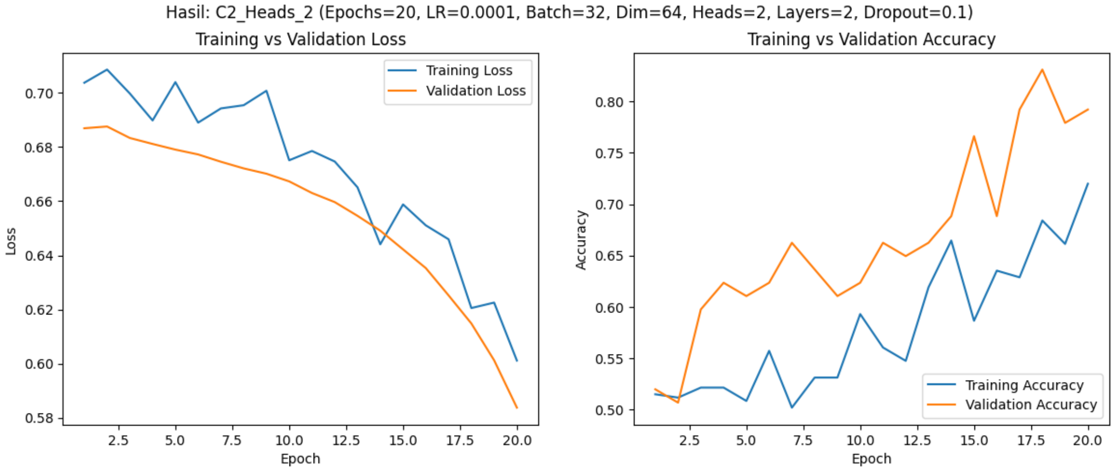
```
Epoch 3/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 3/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 3/50 | Train Loss: 0.7169 | Train Acc: 0.4984 | Val Loss: 0.7023 | Val
Acc: 0.5065

Epoch 4/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 4/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 4/50 | Train Loss: 0.7030 | Train Acc: 0.5505 | Val Loss: 0.6908 | Val
Acc: 0.4805

Epoch 5/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 5/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 5/50 | Train Loss: 0.7250 | Train Acc: 0.4788 | Val Loss: 0.6871 | Val
Acc: 0.5195

Epoch 6/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 6/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 6/50 | Train Loss: 0.6878 | Train Acc: 0.5440 | Val Loss: 0.6848 | Val
Acc: 0.5325

Epoch 7/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 7/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 7/50 | Train Loss: 0.6910 | Train Acc: 0.5505 | Val Loss: 0.6838 | Val
Acc: 0.4935

Epoch 8/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 8/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 8/50 | Train Loss: 0.6894 | Train Acc: 0.5700 | Val Loss: 0.6801 | Val
Acc: 0.5325

Epoch 9/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 9/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 9/50 | Train Loss: 0.6918 | Train Acc: 0.5114 | Val Loss: 0.6776 | Val
Acc: 0.5714

Epoch 10/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 10/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 10/50 | Train Loss: 0.6788 | Train Acc: 0.5537 | Val Loss: 0.6750 | Val
Acc: 0.5065

Epoch 11/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 11/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 11/50 | Train Loss: 0.6924 | Train Acc: 0.5635 | Val Loss: 0.6744 | Val
Acc: 0.5325

Epoch 12/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 12/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 12/50 | Train Loss: 0.6720 | Train Acc: 0.5440 | Val Loss: 0.6690 | Val
Acc: 0.5714

Epoch 13/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 13/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 13/50 | Train Loss: 0.6797 | Train Acc: 0.5700 | Val Loss: 0.6659 | Val
Acc: 0.5844

Epoch 14/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 14/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 14/50 | Train Loss: 0.6814 | Train Acc: 0.5440 | Val Loss: 0.6630 | Val
Acc: 0.5325

Epoch 15/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 15/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 15/50 | Train Loss: 0.6679 | Train Acc: 0.5928 | Val Loss: 0.6594 | Val
Acc: 0.5584

Epoch 16/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 16/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 16/50 | Train Loss: 0.6910 | Train Acc: 0.5407 | Val Loss: 0.6548 | Val
Acc: 0.6883

Epoch 17/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 17/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 17/50 | Train Loss: 0.6556 | Train Acc: 0.6156 | Val Loss: 0.6553 | Val
Acc: 0.5844

Epoch 18/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 18/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 18/50 | Train Loss: 0.6668 | Train Acc: 0.6091 | Val Loss: 0.6479 | Val
Acc: 0.5714

Epoch 19/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 19/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 19/50 | Train Loss: 0.6557 | Train Acc: 0.6189 | Val Loss: 0.6383 | Val
Acc: 0.6753

Epoch 20/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 20/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 20/50 | Train Loss: 0.6535 | Train Acc: 0.6482 | Val Loss: 0.6304 | Val
Acc: 0.7403
Epoch 21/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 21/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 21/50 | Train Loss: 0.6319 | Train Acc: 0.6417 | Val Loss: 0.6204 | Val
Acc: 0.7532
Epoch 22/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 22/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 22/50 | Train Loss: 0.6258 | Train Acc: 0.6808 | Val Loss: 0.6074 | Val
Acc: 0.7532
Epoch 23/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 23/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 23/50 | Train Loss: 0.6201 | Train Acc: 0.7003 | Val Loss: 0.5924 | Val
Acc: 0.7013
Epoch 24/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 24/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 24/50 | Train Loss: 0.5975 | Train Acc: 0.6775 | Val Loss: 0.5686 | Val
Acc: 0.7532
Epoch 25/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 25/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 25/50 | Train Loss: 0.5885 | Train Acc: 0.6938 | Val Loss: 0.5450 | Val
Acc: 0.7532
Epoch 26/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 26/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 26/50 | Train Loss: 0.5722 | Train Acc: 0.7003 | Val Loss: 0.5213 | Val
Acc: 0.7532
Epoch 27/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 27/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 27/50 | Train Loss: 0.5446 | Train Acc: 0.7199 | Val Loss: 0.4963 | Val
Acc: 0.7662
Epoch 28/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 28/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 28/50 | Train Loss: 0.5417 | Train Acc: 0.7459 | Val Loss: 0.4716 | Val
Acc: 0.7662
```

```
Epoch 29/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 29/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 29/50 | Train Loss: 0.5079 | Train Acc: 0.7524 | Val Loss: 0.4461 | Val
Acc: 0.8312

Epoch 30/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 30/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 30/50 | Train Loss: 0.4802 | Train Acc: 0.7883 | Val Loss: 0.4268 | Val
Acc: 0.7662

Epoch 31/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 31/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 31/50 | Train Loss: 0.4719 | Train Acc: 0.7883 | Val Loss: 0.4038 | Val
Acc: 0.8442

Epoch 32/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 32/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 32/50 | Train Loss: 0.4304 | Train Acc: 0.8111 | Val Loss: 0.3832 | Val
Acc: 0.8442

Epoch 33/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 33/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 33/50 | Train Loss: 0.4285 | Train Acc: 0.8078 | Val Loss: 0.3636 | Val
Acc: 0.8312

Epoch 34/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 34/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 34/50 | Train Loss: 0.4074 | Train Acc: 0.8404 | Val Loss: 0.3390 | Val
Acc: 0.8442

Epoch 35/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 35/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 35/50 | Train Loss: 0.4108 | Train Acc: 0.8078 | Val Loss: 0.3344 | Val
Acc: 0.8312

Epoch 36/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 36/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 36/50 | Train Loss: 0.3603 | Train Acc: 0.8469 | Val Loss: 0.3157 | Val
Acc: 0.8442

Epoch 37/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 37/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 37/50 | Train Loss: 0.3495 | Train Acc: 0.8469 | Val Loss: 0.2971 | Val
Acc: 0.8701

Epoch 38/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 38/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 38/50 | Train Loss: 0.3347 | Train Acc: 0.8339 | Val Loss: 0.3008 | Val
Acc: 0.8571

Epoch 39/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 39/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 39/50 | Train Loss: 0.2975 | Train Acc: 0.8795 | Val Loss: 0.2895 | Val
Acc: 0.8571

Epoch 40/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 40/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 40/50 | Train Loss: 0.2733 | Train Acc: 0.9088 | Val Loss: 0.2835 | Val
Acc: 0.8571

Epoch 41/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 41/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 41/50 | Train Loss: 0.2619 | Train Acc: 0.8958 | Val Loss: 0.2808 | Val
Acc: 0.8571

Epoch 42/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 42/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 42/50 | Train Loss: 0.2516 | Train Acc: 0.9186 | Val Loss: 0.2704 | Val
Acc: 0.8701

Epoch 43/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 43/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 43/50 | Train Loss: 0.2414 | Train Acc: 0.8990 | Val Loss: 0.2657 | Val
Acc: 0.8961

Epoch 44/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 44/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 44/50 | Train Loss: 0.2380 | Train Acc: 0.9023 | Val Loss: 0.2876 | Val
Acc: 0.8701

Epoch 45/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 45/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 45/50 | Train Loss: 0.2012 | Train Acc: 0.9088 | Val Loss: 0.2447 | Val
Acc: 0.8961

Epoch 46/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 46/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 46/50 | Train Loss: 0.1849 | Train Acc: 0.9283 | Val Loss: 0.2751 | Val Acc: 0.8701

Epoch 47/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 47/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 47/50 | Train Loss: 0.1666 | Train Acc: 0.9349 | Val Loss: 0.2341 | Val Acc: 0.8961

Epoch 48/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 48/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 48/50 | Train Loss: 0.1744 | Train Acc: 0.9283 | Val Loss: 0.3131 | Val Acc: 0.8312

Epoch 49/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 49/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 49/50 | Train Loss: 0.2172 | Train Acc: 0.9055 | Val Loss: 0.2226 | Val Acc: 0.8961

Epoch 50/50 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 50/50 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 50/50 | Train Loss: 0.1637 | Train Acc: 0.9349 | Val Loss: 0.2666 | Val Acc: 0.8571

--- Hasil Eksperimen: C1_Epochs_50 ---
Waktu Training Total: 307.06 detik
Final Train Loss: 0.1637
Final Train Acc: 0.9349
Final Val Loss: 0.2666
Final Val Acc: 0.8571
```

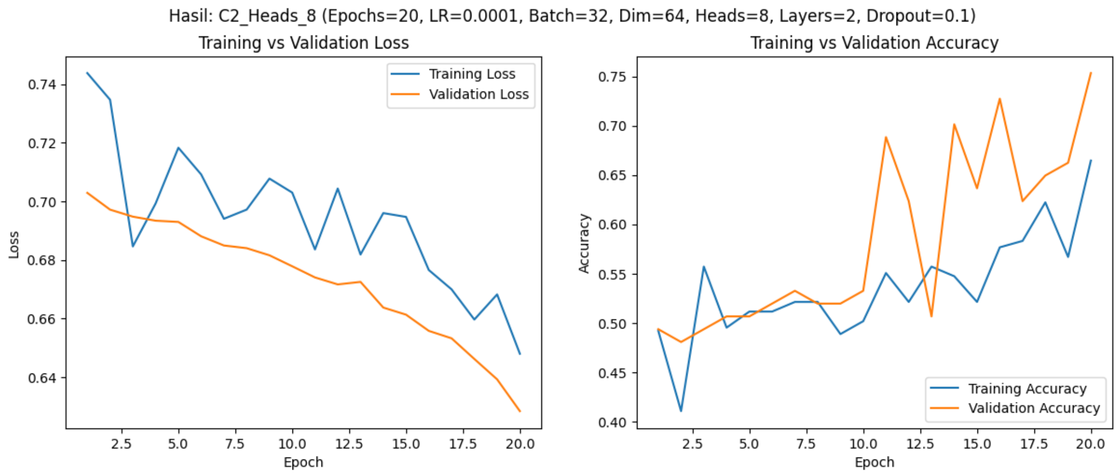


```
Grafik disimpan sebagai: hasil_c1_epochs_50_(epochs50,_lr00001,_batch32,_dim64,_
heads4,_layers2,_dropout01).png
==================================================

==================================================
MULAI EKSPERIMEN: C2_Heads_2
Konfigurasi: {'lr': 0.0001, 'batch_size': 32, 'embed_dim': 64, 'n_heads': 2,
'num_layers': 2, 'ff_dim': 128, 'dropout': 0.1, 'epochs': 20, 'weight_decay':
0.0, 'name': 'C2_Heads_2'}
==================================================

Epoch 1/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 1/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 1/20 | Train Loss: 0.7038 | Train Acc: 0.5147 | Val Loss: 0.6870 | Val
Acc: 0.5195

Epoch 2/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 2/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 2/20 | Train Loss: 0.7086 | Train Acc: 0.5114 | Val Loss: 0.6876 | Val
Acc: 0.5065

Epoch 3/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 3/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 3/20 | Train Loss: 0.6998 | Train Acc: 0.5212 | Val Loss: 0.6834 | Val
Acc: 0.5974

Epoch 4/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 4/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 4/20 | Train Loss: 0.6898 | Train Acc: 0.5212 | Val Loss: 0.6812 | Val
Acc: 0.6234

Epoch 5/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 5/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 5/20 | Train Loss: 0.7040 | Train Acc: 0.5081 | Val Loss: 0.6791 | Val
Acc: 0.6104

Epoch 6/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 6/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 6/20 | Train Loss: 0.6890 | Train Acc: 0.5570 | Val Loss: 0.6773 | Val
Acc: 0.6234

Epoch 7/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 7/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 7/20 | Train Loss: 0.6943 | Train Acc: 0.5016 | Val Loss: 0.6746 | Val
Acc: 0.6623

Epoch 8/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 8/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 8/20 | Train Loss: 0.6955 | Train Acc: 0.5309 | Val Loss: 0.6721 | Val
Acc: 0.6364

Epoch 9/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 9/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 9/20 | Train Loss: 0.7008 | Train Acc: 0.5309 | Val Loss: 0.6702 | Val
Acc: 0.6104

Epoch 10/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 10/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 10/20 | Train Loss: 0.6751 | Train Acc: 0.5928 | Val Loss: 0.6673 | Val
Acc: 0.6234

Epoch 11/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 11/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 11/20 | Train Loss: 0.6786 | Train Acc: 0.5603 | Val Loss: 0.6630 | Val
Acc: 0.6623

Epoch 12/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 12/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 12/20 | Train Loss: 0.6747 | Train Acc: 0.5472 | Val Loss: 0.6597 | Val
Acc: 0.6494

Epoch 13/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 13/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 13/20 | Train Loss: 0.6651 | Train Acc: 0.6189 | Val Loss: 0.6546 | Val
Acc: 0.6623

Epoch 14/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 14/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 14/20 | Train Loss: 0.6441 | Train Acc: 0.6645 | Val Loss: 0.6491 | Val
Acc: 0.6883

Epoch 15/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 15/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 15/20 | Train Loss: 0.6588 | Train Acc: 0.5863 | Val Loss: 0.6422 | Val
Acc: 0.7662
```

```
Epoch 16/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 16/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 16/20 | Train Loss: 0.6511 | Train Acc: 0.6352 | Val Loss: 0.6353 | Val
Acc: 0.6883

Epoch 17/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 17/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 17/20 | Train Loss: 0.6459 | Train Acc: 0.6287 | Val Loss: 0.6252 | Val
Acc: 0.7922

Epoch 18/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 18/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 18/20 | Train Loss: 0.6205 | Train Acc: 0.6840 | Val Loss: 0.6148 | Val
Acc: 0.8312

Epoch 19/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 19/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 19/20 | Train Loss: 0.6225 | Train Acc: 0.6612 | Val Loss: 0.6012 | Val
Acc: 0.7792

Epoch 20/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 20/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 20/20 | Train Loss: 0.6011 | Train Acc: 0.7199 | Val Loss: 0.5837 | Val
Acc: 0.7922

--- Hasil Eksperimen: C2_Heads_2 ---
Waktu Training Total: 422.71 detik
Final Train Loss: 0.6011
Final Train Acc: 0.7199
Final Val Loss: 0.5837
Final Val Acc: 0.7922
```

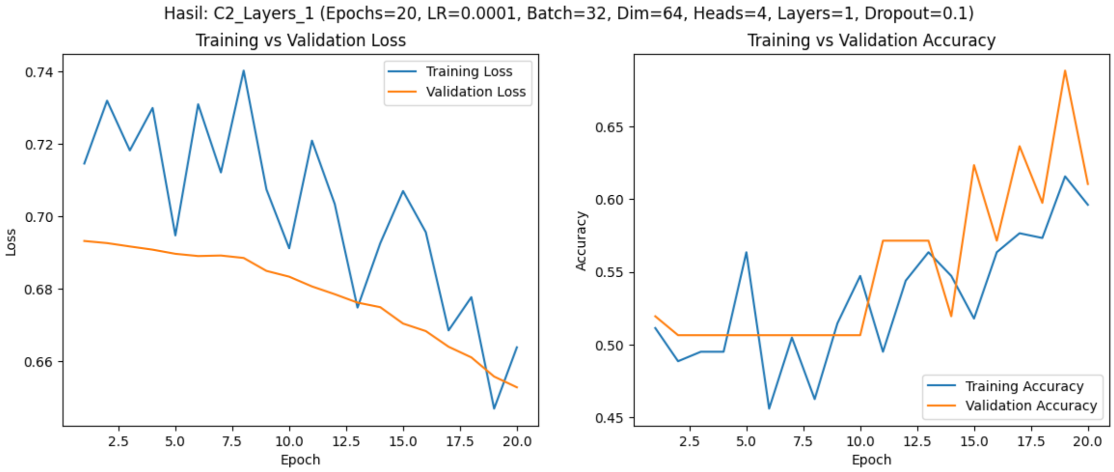


```
Grafik disimpan sebagai: hasil_c2_heads_2_(epochs20,_lr00001,_batch32,_dim64,_he
ads2,_layers2,_dropout01).png
==================================================

==================================================
MULAI EKSPERIMEN: C2_Heads_8
Konfigurasi: {'lr': 0.0001, 'batch_size': 32, 'embed_dim': 64, 'n_heads': 8,
'num_layers': 2, 'ff_dim': 128, 'dropout': 0.1, 'epochs': 20, 'weight_decay':
0.0, 'name': 'C2_Heads_8'}
==================================================

Epoch 1/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 1/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 1/20 | Train Loss: 0.7437 | Train Acc: 0.4919 | Val Loss: 0.7028 | Val
Acc: 0.4935

Epoch 2/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 2/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 2/20 | Train Loss: 0.7346 | Train Acc: 0.4104 | Val Loss: 0.6971 | Val
Acc: 0.4805

Epoch 3/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 3/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 3/20 | Train Loss: 0.6846 | Train Acc: 0.5570 | Val Loss: 0.6947 | Val
Acc: 0.4935

Epoch 4/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 4/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 4/20 | Train Loss: 0.6992 | Train Acc: 0.4951 | Val Loss: 0.6933 | Val
Acc: 0.5065

Epoch 5/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 5/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 5/20 | Train Loss: 0.7183 | Train Acc: 0.5114 | Val Loss: 0.6929 | Val
Acc: 0.5065

Epoch 6/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 6/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 6/20 | Train Loss: 0.7091 | Train Acc: 0.5114 | Val Loss: 0.6880 | Val
Acc: 0.5195

Epoch 7/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 7/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 7/20 | Train Loss: 0.6940 | Train Acc: 0.5212 | Val Loss: 0.6849 | Val
Acc: 0.5325

Epoch 8/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 8/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 8/20 | Train Loss: 0.6971 | Train Acc: 0.5212 | Val Loss: 0.6840 | Val
Acc: 0.5195

Epoch 9/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 9/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 9/20 | Train Loss: 0.7077 | Train Acc: 0.4886 | Val Loss: 0.6815 | Val
Acc: 0.5195

Epoch 10/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 10/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 10/20 | Train Loss: 0.7029 | Train Acc: 0.5016 | Val Loss: 0.6778 | Val
Acc: 0.5325

Epoch 11/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 11/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 11/20 | Train Loss: 0.6835 | Train Acc: 0.5505 | Val Loss: 0.6740 | Val
Acc: 0.6883

Epoch 12/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 12/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 12/20 | Train Loss: 0.7043 | Train Acc: 0.5212 | Val Loss: 0.6716 | Val
Acc: 0.6234

Epoch 13/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 13/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 13/20 | Train Loss: 0.6818 | Train Acc: 0.5570 | Val Loss: 0.6725 | Val
Acc: 0.5065

Epoch 14/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 14/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 14/20 | Train Loss: 0.6959 | Train Acc: 0.5472 | Val Loss: 0.6637 | Val
Acc: 0.7013

Epoch 15/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 15/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 15/20 | Train Loss: 0.6946 | Train Acc: 0.5212 | Val Loss: 0.6613 | Val
Acc: 0.6364

Epoch 16/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 16/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 16/20 | Train Loss: 0.6765 | Train Acc: 0.5765 | Val Loss: 0.6557 | Val
Acc: 0.7273

Epoch 17/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 17/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 17/20 | Train Loss: 0.6699 | Train Acc: 0.5831 | Val Loss: 0.6532 | Val
Acc: 0.6234

Epoch 18/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 18/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 18/20 | Train Loss: 0.6596 | Train Acc: 0.6221 | Val Loss: 0.6461 | Val
Acc: 0.6494

Epoch 19/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 19/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 19/20 | Train Loss: 0.6682 | Train Acc: 0.5668 | Val Loss: 0.6392 | Val
Acc: 0.6623

Epoch 20/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 20/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 20/20 | Train Loss: 0.6479 | Train Acc: 0.6645 | Val Loss: 0.6283 | Val
Acc: 0.7532

--- Hasil Eksperimen: C2_Heads_8 ---
Waktu Training Total: 406.20 detik
Final Train Loss: 0.6479
Final Train Acc: 0.6645
Final Val Loss: 0.6283
Final Val Acc: 0.7532
```



```
Grafik disimpan sebagai: hasil_c2_heads_8_(epochs20,_lr00001,_batch32,_dim64,_he
ads8,_layers2,_dropout01).png
==================================================

==================================================
MULAI EKSPERIMEN: C2_Layers_1
Konfigurasi: {'lr': 0.0001, 'batch_size': 32, 'embed_dim': 64, 'n_heads': 4,
'num_layers': 1, 'ff_dim': 128, 'dropout': 0.1, 'epochs': 20, 'weight_decay':
0.0, 'name': 'C2_Layers_1'}
==================================================

Epoch 1/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 1/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 1/20 | Train Loss: 0.7146 | Train Acc: 0.5114 | Val Loss: 0.6932 | Val
Acc: 0.5195

Epoch 2/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 2/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 2/20 | Train Loss: 0.7319 | Train Acc: 0.4886 | Val Loss: 0.6926 | Val
Acc: 0.5065

Epoch 3/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 3/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 3/20 | Train Loss: 0.7182 | Train Acc: 0.4951 | Val Loss: 0.6917 | Val
Acc: 0.5065

Epoch 4/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 4/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 4/20 | Train Loss: 0.7299 | Train Acc: 0.4951 | Val Loss: 0.6908 | Val
Acc: 0.5065

Epoch 5/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 5/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 5/20 | Train Loss: 0.6947 | Train Acc: 0.5635 | Val Loss: 0.6897 | Val
Acc: 0.5065

Epoch 6/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 6/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 6/20 | Train Loss: 0.7309 | Train Acc: 0.4560 | Val Loss: 0.6891 | Val
Acc: 0.5065

Epoch 7/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 7/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 7/20 | Train Loss: 0.7121 | Train Acc: 0.5049 | Val Loss: 0.6892 | Val
Acc: 0.5065

Epoch 8/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 8/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 8/20 | Train Loss: 0.7402 | Train Acc: 0.4625 | Val Loss: 0.6885 | Val
Acc: 0.5065

Epoch 9/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 9/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 9/20 | Train Loss: 0.7074 | Train Acc: 0.5147 | Val Loss: 0.6850 | Val
Acc: 0.5065

Epoch 10/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 10/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 10/20 | Train Loss: 0.6912 | Train Acc: 0.5472 | Val Loss: 0.6834 | Val
Acc: 0.5065

Epoch 11/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 11/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 11/20 | Train Loss: 0.7209 | Train Acc: 0.4951 | Val Loss: 0.6807 | Val
Acc: 0.5714

Epoch 12/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 12/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 12/20 | Train Loss: 0.7034 | Train Acc: 0.5440 | Val Loss: 0.6785 | Val
Acc: 0.5714
```

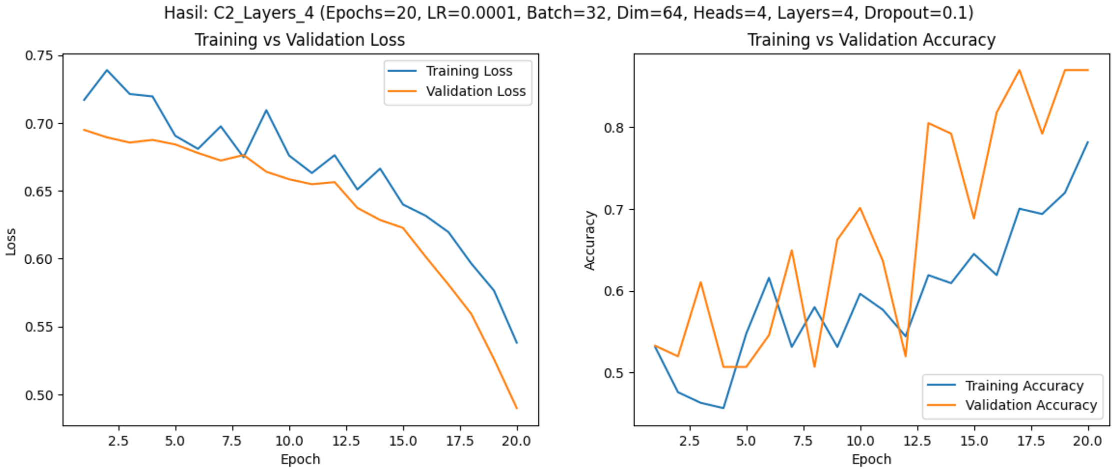
```
Epoch 13/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 13/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 13/20 | Train Loss: 0.6749 | Train Acc: 0.5635 | Val Loss: 0.6762 | Val
Acc: 0.5714

Epoch 14/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 14/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 14/20 | Train Loss: 0.6926 | Train Acc: 0.5472 | Val Loss: 0.6750 | Val
Acc: 0.5195

Epoch 15/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 15/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 15/20 | Train Loss: 0.7070 | Train Acc: 0.5179 | Val Loss: 0.6705 | Val
Acc: 0.6234

Epoch 16/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 16/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 16/20 | Train Loss: 0.6956 | Train Acc: 0.5635 | Val Loss: 0.6684 | Val
Acc: 0.5714

Epoch 17/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 17/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 17/20 | Train Loss: 0.6686 | Train Acc: 0.5765 | Val Loss: 0.6641 | Val
Acc: 0.6364

Epoch 18/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 18/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 18/20 | Train Loss: 0.6777 | Train Acc: 0.5733 | Val Loss: 0.6611 | Val
Acc: 0.5974

Epoch 19/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 19/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 19/20 | Train Loss: 0.6470 | Train Acc: 0.6156 | Val Loss: 0.6559 | Val
Acc: 0.6883

Epoch 20/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 20/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 20/20 | Train Loss: 0.6639 | Train Acc: 0.5961 | Val Loss: 0.6529 | Val
Acc: 0.6104

--- Hasil Eksperimen: C2_Layers_1 ---
Waktu Training Total: 327.46 detik
Final Train Loss: 0.6639
Final Train Acc: 0.5961
Final Val Loss: 0.6529
Final Val Acc: 0.6104
```



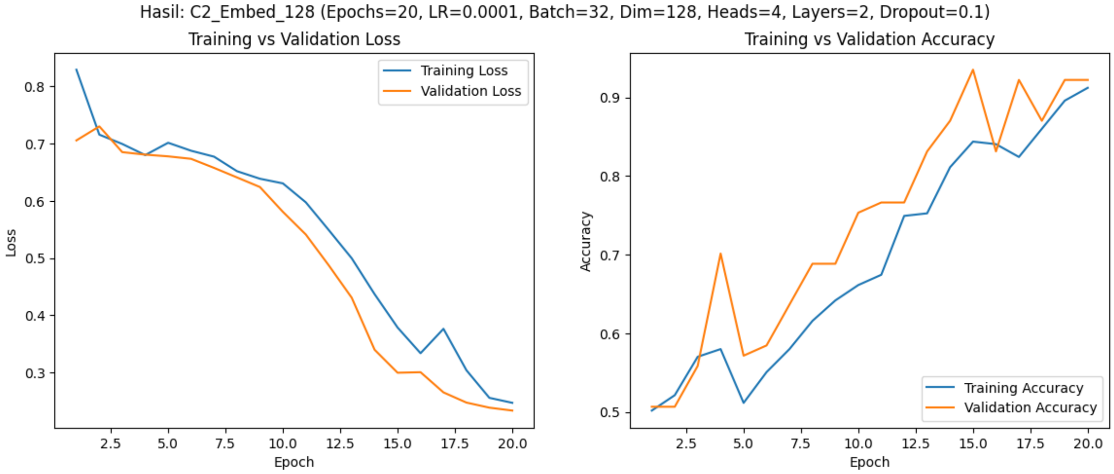
```
Grafik disimpan sebagai: hasil_c2_layers_1_(epochs20,_lr00001,_batch32,_dim64,_h
eads4,_layers1,_dropout01).png
============================================================

============================================================
MULAI EKSPERIMEN: C2_Layers_4
Konfigurasi: {'lr': 0.0001, 'batch_size': 32, 'embed_dim': 64, 'n_heads': 4,
'num_layers': 4, 'ff_dim': 128, 'dropout': 0.1, 'epochs': 20, 'weight_decay':
0.0, 'name': 'C2_Layers_4'}
============================================================

Epoch 1/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 1/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 1/20 | Train Loss: 0.7170 | Train Acc: 0.5309 | Val Loss: 0.6949 | Val
Acc: 0.5325

Epoch 2/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 2/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 2/20 | Train Loss: 0.7390 | Train Acc: 0.4756 | Val Loss: 0.6894 | Val
Acc: 0.5195

Epoch 3/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 3/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 3/20 | Train Loss: 0.7213 | Train Acc: 0.4625 | Val Loss: 0.6856 | Val
Acc: 0.6104
```

```
Epoch 4/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 4/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 4/20 | Train Loss: 0.7196 | Train Acc: 0.4560 | Val Loss: 0.6875 | Val
Acc: 0.5065

Epoch 5/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 5/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 5/20 | Train Loss: 0.6905 | Train Acc: 0.5472 | Val Loss: 0.6842 | Val
Acc: 0.5065

Epoch 6/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 6/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 6/20 | Train Loss: 0.6809 | Train Acc: 0.6156 | Val Loss: 0.6778 | Val
Acc: 0.5455

Epoch 7/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 7/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 7/20 | Train Loss: 0.6975 | Train Acc: 0.5309 | Val Loss: 0.6723 | Val
Acc: 0.6494

Epoch 8/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 8/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 8/20 | Train Loss: 0.6747 | Train Acc: 0.5798 | Val Loss: 0.6763 | Val
Acc: 0.5065

Epoch 9/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 9/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 9/20 | Train Loss: 0.7094 | Train Acc: 0.5309 | Val Loss: 0.6641 | Val
Acc: 0.6623

Epoch 10/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 10/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 10/20 | Train Loss: 0.6760 | Train Acc: 0.5961 | Val Loss: 0.6585 | Val
Acc: 0.7013

Epoch 11/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 11/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 11/20 | Train Loss: 0.6631 | Train Acc: 0.5765 | Val Loss: 0.6549 | Val
Acc: 0.6364

Epoch 12/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 12/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 12/20 | Train Loss: 0.6762 | Train Acc: 0.5440 | Val Loss: 0.6564 | Val
Acc: 0.5195

Epoch 13/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 13/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 13/20 | Train Loss: 0.6510 | Train Acc: 0.6189 | Val Loss: 0.6374 | Val
Acc: 0.8052

Epoch 14/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 14/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 14/20 | Train Loss: 0.6664 | Train Acc: 0.6091 | Val Loss: 0.6284 | Val
Acc: 0.7922

Epoch 15/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 15/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 15/20 | Train Loss: 0.6399 | Train Acc: 0.6450 | Val Loss: 0.6227 | Val
Acc: 0.6883

Epoch 16/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 16/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 16/20 | Train Loss: 0.6316 | Train Acc: 0.6189 | Val Loss: 0.6014 | Val
Acc: 0.8182

Epoch 17/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 17/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 17/20 | Train Loss: 0.6196 | Train Acc: 0.7003 | Val Loss: 0.5809 | Val
Acc: 0.8701

Epoch 18/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 18/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 18/20 | Train Loss: 0.5965 | Train Acc: 0.6938 | Val Loss: 0.5593 | Val
Acc: 0.7922

Epoch 19/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 19/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 19/20 | Train Loss: 0.5765 | Train Acc: 0.7199 | Val Loss: 0.5259 | Val
Acc: 0.8701

Epoch 20/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 20/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 20/20 | Train Loss: 0.5380 | Train Acc: 0.7818 | Val Loss: 0.4898 | Val
Acc: 0.8701

--- Hasil Eksperimen: C2_Layers_4 ---
```

```
Waktu Training Total: 611.49 detik
Final Train Loss: 0.5380
Final Train Acc: 0.7818
Final Val Loss: 0.4898
Final Val Acc: 0.8701
```

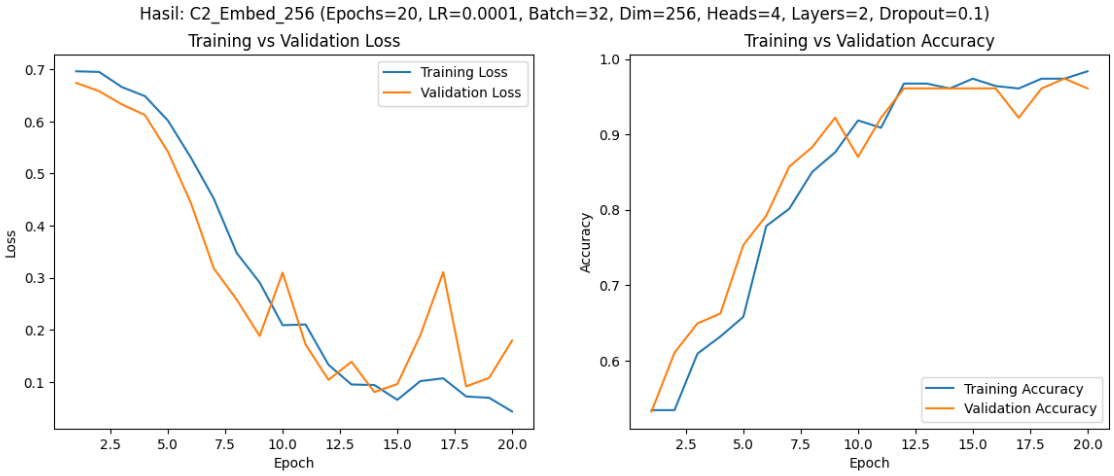


```
Grafik disimpan sebagai: hasil_c2_layers_4_(epochs20,_lr00001,_batch32,_dim64,_h
eads4,_layers4,_dropout01).png
==================================================

==================================================
MULAI EKSPERIMEN: C2_Embed_128
Konfigurasi: {'lr': 0.0001, 'batch_size': 32, 'embed_dim': 128, 'n_heads': 4,
'num_layers': 2, 'ff_dim': 256, 'dropout': 0.1, 'epochs': 20, 'weight_decay':
0.0, 'name': 'C2_Embed_128'}
==================================================

Epoch 1/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 1/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 1/20 | Train Loss: 0.8289 | Train Acc: 0.5016 | Val Loss: 0.7054 | Val
Acc: 0.5065

Epoch 2/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 2/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 2/20 | Train Loss: 0.7155 | Train Acc: 0.5212 | Val Loss: 0.7300 | Val
Acc: 0.5065

Epoch 3/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 3/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 3/20 | Train Loss: 0.6992 | Train Acc: 0.5700 | Val Loss: 0.6850 | Val
Acc: 0.5584

Epoch 4/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 4/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 4/20 | Train Loss: 0.6799 | Train Acc: 0.5798 | Val Loss: 0.6806 | Val
Acc: 0.7013

Epoch 5/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 5/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 5/20 | Train Loss: 0.7013 | Train Acc: 0.5114 | Val Loss: 0.6776 | Val
Acc: 0.5714

Epoch 6/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 6/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 6/20 | Train Loss: 0.6874 | Train Acc: 0.5505 | Val Loss: 0.6733 | Val
Acc: 0.5844

Epoch 7/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 7/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 7/20 | Train Loss: 0.6771 | Train Acc: 0.5798 | Val Loss: 0.6575 | Val
Acc: 0.6364

Epoch 8/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 8/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 8/20 | Train Loss: 0.6518 | Train Acc: 0.6156 | Val Loss: 0.6408 | Val
Acc: 0.6883

Epoch 9/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 9/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 9/20 | Train Loss: 0.6386 | Train Acc: 0.6417 | Val Loss: 0.6241 | Val
Acc: 0.6883

Epoch 10/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 10/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 10/20 | Train Loss: 0.6304 | Train Acc: 0.6612 | Val Loss: 0.5808 | Val
Acc: 0.7532

Epoch 11/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 11/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 11/20 | Train Loss: 0.5974 | Train Acc: 0.6743 | Val Loss: 0.5412 | Val
Acc: 0.7662

Epoch 12/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 12/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 12/20 | Train Loss: 0.5489 | Train Acc: 0.7492 | Val Loss: 0.4874 | Val
Acc: 0.7662
Epoch 13/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 13/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 13/20 | Train Loss: 0.4997 | Train Acc: 0.7524 | Val Loss: 0.4309 | Val
Acc: 0.8312
Epoch 14/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 14/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 14/20 | Train Loss: 0.4369 | Train Acc: 0.8111 | Val Loss: 0.3399 | Val
Acc: 0.8701
Epoch 15/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 15/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 15/20 | Train Loss: 0.3788 | Train Acc: 0.8436 | Val Loss: 0.2999 | Val
Acc: 0.9351
Epoch 16/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 16/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 16/20 | Train Loss: 0.3340 | Train Acc: 0.8404 | Val Loss: 0.3008 | Val
Acc: 0.8312
Epoch 17/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 17/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 17/20 | Train Loss: 0.3765 | Train Acc: 0.8241 | Val Loss: 0.2656 | Val
Acc: 0.9221
Epoch 18/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 18/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 18/20 | Train Loss: 0.3042 | Train Acc: 0.8599 | Val Loss: 0.2478 | Val
Acc: 0.8701
Epoch 19/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 19/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 19/20 | Train Loss: 0.2561 | Train Acc: 0.8958 | Val Loss: 0.2389 | Val
Acc: 0.9221
Epoch 20/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 20/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 20/20 | Train Loss: 0.2474 | Train Acc: 0.9121 | Val Loss: 0.2339 | Val
Acc: 0.9221

--- Hasil Eksperimen: C2_Embed_128 ---
Waktu Training Total: 642.84 detik
Final Train Loss: 0.2474
Final Train Acc: 0.9121
Final Val Loss: 0.2339
Final Val Acc: 0.9221
```



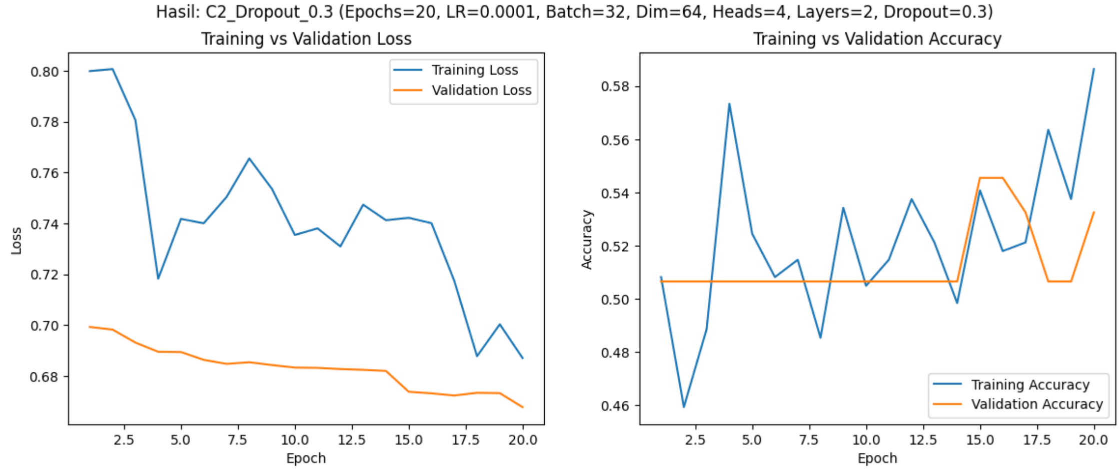
```
Grafik disimpan sebagai: hasil_c2_embed_128_(epochs20,_lr00001,_batch32,_dim128,
_heads4,_layers2,_dropout01).png
==================================================

==================================================
MULAI EKSPERIMEN: C2_Embed_256
Konfigurasi: {'lr': 0.0001, 'batch_size': 32, 'embed_dim': 256, 'n_heads': 4,
'num_layers': 2, 'ff_dim': 512, 'dropout': 0.1, 'epochs': 20, 'weight_decay':
0.0, 'name': 'C2_Embed_256'}
==================================================

Epoch 1/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 1/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 1/20 | Train Loss: 0.6962 | Train Acc: 0.5342 | Val Loss: 0.6739 | Val
Acc: 0.5325

Epoch 2/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 2/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 2/20 | Train Loss: 0.6950 | Train Acc: 0.5342 | Val Loss: 0.6582 | Val
Acc: 0.6104
```

```
Epoch 3/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 3/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 3/20 | Train Loss: 0.6658 | Train Acc: 0.6091 | Val Loss: 0.6325 | Val
Acc: 0.6494

Epoch 4/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 4/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 4/20 | Train Loss: 0.6485 | Train Acc: 0.6319 | Val Loss: 0.6123 | Val
Acc: 0.6623

Epoch 5/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 5/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 5/20 | Train Loss: 0.6016 | Train Acc: 0.6580 | Val Loss: 0.5418 | Val
Acc: 0.7532

Epoch 6/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 6/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 6/20 | Train Loss: 0.5307 | Train Acc: 0.7785 | Val Loss: 0.4439 | Val
Acc: 0.7922

Epoch 7/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 7/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 7/20 | Train Loss: 0.4518 | Train Acc: 0.8013 | Val Loss: 0.3180 | Val
Acc: 0.8571

Epoch 8/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 8/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 8/20 | Train Loss: 0.3474 | Train Acc: 0.8502 | Val Loss: 0.2579 | Val
Acc: 0.8831

Epoch 9/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 9/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 9/20 | Train Loss: 0.2908 | Train Acc: 0.8762 | Val Loss: 0.1882 | Val
Acc: 0.9221

Epoch 10/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 10/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 10/20 | Train Loss: 0.2090 | Train Acc: 0.9186 | Val Loss: 0.3097 | Val
Acc: 0.8701

Epoch 11/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 11/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 11/20 | Train Loss: 0.2103 | Train Acc: 0.9088 | Val Loss: 0.1719 | Val
Acc: 0.9221

Epoch 12/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 12/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 12/20 | Train Loss: 0.1330 | Train Acc: 0.9674 | Val Loss: 0.1040 | Val
Acc: 0.9610

Epoch 13/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 13/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 13/20 | Train Loss: 0.0952 | Train Acc: 0.9674 | Val Loss: 0.1388 | Val
Acc: 0.9610

Epoch 14/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 14/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 14/20 | Train Loss: 0.0941 | Train Acc: 0.9609 | Val Loss: 0.0806 | Val
Acc: 0.9610

Epoch 15/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 15/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 15/20 | Train Loss: 0.0657 | Train Acc: 0.9739 | Val Loss: 0.0960 | Val
Acc: 0.9610

Epoch 16/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 16/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 16/20 | Train Loss: 0.1016 | Train Acc: 0.9642 | Val Loss: 0.1895 | Val
Acc: 0.9610

Epoch 17/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 17/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 17/20 | Train Loss: 0.1070 | Train Acc: 0.9609 | Val Loss: 0.3108 | Val
Acc: 0.9221

Epoch 18/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 18/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 18/20 | Train Loss: 0.0721 | Train Acc: 0.9739 | Val Loss: 0.0913 | Val
Acc: 0.9610

Epoch 19/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 19/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 19/20 | Train Loss: 0.0696 | Train Acc: 0.9739 | Val Loss: 0.1079 | Val
Acc: 0.9740

Epoch 20/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 20/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 20/20 | Train Loss: 0.0434 | Train Acc: 0.9837 | Val Loss: 0.1794 | Val
Acc: 0.9610

--- Hasil Eksperimen: C2_Embed_256 ---
Waktu Training Total: 528.87 detik
Final Train Loss: 0.0434
Final Train Acc: 0.9837
Final Val Loss: 0.1794
Final Val Acc: 0.9610
```



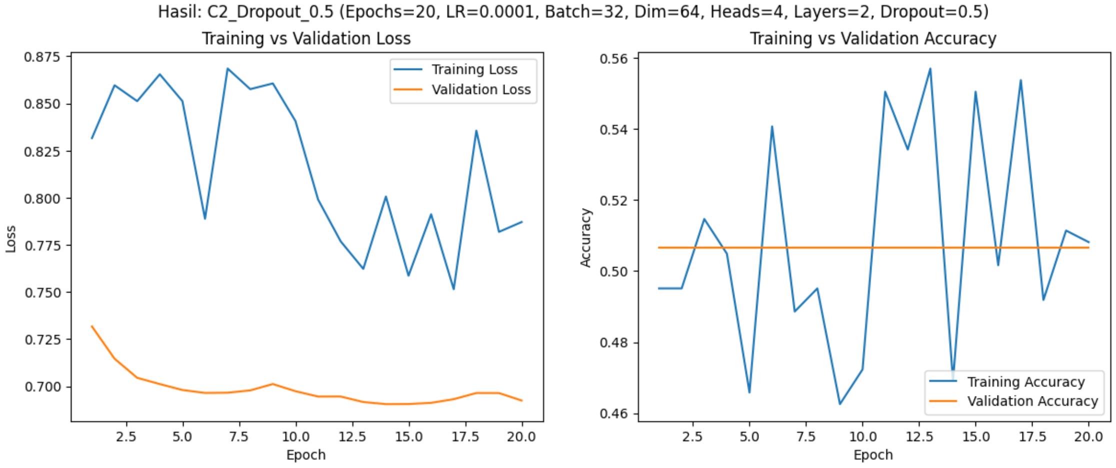
```
Grafik disimpan sebagai: hasil_c2_embed_256_(epochs20,_lr00001,_batch32,_dim256,
_heads4,_layers2,_dropout01).png
==================================================

==================================================
MULAI EKSPERIMEN: C2_Dropout_0.3
Konfigurasi: {'lr': 0.0001, 'batch_size': 32, 'embed_dim': 64, 'n_heads': 4,
'num_layers': 2, 'ff_dim': 128, 'dropout': 0.3, 'epochs': 20, 'weight_decay':
0.0, 'name': 'C2_Dropout_0.3'}
==================================================

Epoch 1/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 1/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 1/20 | Train Loss: 0.7998 | Train Acc: 0.5081 | Val Loss: 0.6992 | Val
Acc: 0.5065

Epoch 2/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 2/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 2/20 | Train Loss: 0.8006 | Train Acc: 0.4593 | Val Loss: 0.6982 | Val
Acc: 0.5065

Epoch 3/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 3/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 3/20 | Train Loss: 0.7806 | Train Acc: 0.4886 | Val Loss: 0.6931 | Val
Acc: 0.5065

Epoch 4/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 4/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 4/20 | Train Loss: 0.7182 | Train Acc: 0.5733 | Val Loss: 0.6895 | Val
Acc: 0.5065

Epoch 5/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 5/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 5/20 | Train Loss: 0.7417 | Train Acc: 0.5244 | Val Loss: 0.6894 | Val
Acc: 0.5065

Epoch 6/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 6/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 6/20 | Train Loss: 0.7400 | Train Acc: 0.5081 | Val Loss: 0.6863 | Val
Acc: 0.5065

Epoch 7/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 7/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 7/20 | Train Loss: 0.7503 | Train Acc: 0.5147 | Val Loss: 0.6847 | Val
Acc: 0.5065

Epoch 8/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 8/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 8/20 | Train Loss: 0.7655 | Train Acc: 0.4853 | Val Loss: 0.6854 | Val
Acc: 0.5065

Epoch 9/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 9/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 9/20 | Train Loss: 0.7535 | Train Acc: 0.5342 | Val Loss: 0.6843 | Val
Acc: 0.5065

Epoch 10/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 10/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 10/20 | Train Loss: 0.7354 | Train Acc: 0.5049 | Val Loss: 0.6833 | Val
Acc: 0.5065

Epoch 11/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 11/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 11/20 | Train Loss: 0.7380 | Train Acc: 0.5147 | Val Loss: 0.6832 | Val
Acc: 0.5065

Epoch 12/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 12/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 12/20 | Train Loss: 0.7309 | Train Acc: 0.5375 | Val Loss: 0.6827 | Val
Acc: 0.5065

Epoch 13/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 13/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 13/20 | Train Loss: 0.7473 | Train Acc: 0.5212 | Val Loss: 0.6824 | Val
Acc: 0.5065

Epoch 14/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 14/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 14/20 | Train Loss: 0.7412 | Train Acc: 0.4984 | Val Loss: 0.6820 | Val
Acc: 0.5065

Epoch 15/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 15/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 15/20 | Train Loss: 0.7422 | Train Acc: 0.5407 | Val Loss: 0.6738 | Val
Acc: 0.5455

Epoch 16/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 16/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 16/20 | Train Loss: 0.7400 | Train Acc: 0.5179 | Val Loss: 0.6731 | Val
Acc: 0.5455

Epoch 17/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 17/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 17/20 | Train Loss: 0.7174 | Train Acc: 0.5212 | Val Loss: 0.6723 | Val
Acc: 0.5325

Epoch 18/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 18/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 18/20 | Train Loss: 0.6877 | Train Acc: 0.5635 | Val Loss: 0.6734 | Val
Acc: 0.5065

Epoch 19/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 19/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 19/20 | Train Loss: 0.7003 | Train Acc: 0.5375 | Val Loss: 0.6732 | Val
Acc: 0.5065
```

```
Epoch 20/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 20/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 20/20 | Train Loss: 0.6870 | Train Acc: 0.5863 | Val Loss: 0.6677 | Val
Acc: 0.5325

--- Hasil Eksperimen: C2_Dropout_0.3 ---
Waktu Training Total: 118.37 detik
Final Train Loss: 0.6870
Final Train Acc: 0.5863
Final Val Loss: 0.6677
Final Val Acc: 0.5325
```



```
Grafik disimpan sebagai: hasil_c2_dropout_03_(epochs20,_lr00001,_batch32,_dim64,
_heads4,_layers2,_dropout03).png
==================================================

==================================================
MULAI EKSPERIMEN: C2_Dropout_0.5
Konfigurasi: {'lr': 0.0001, 'batch_size': 32, 'embed_dim': 64, 'n_heads': 4,
'num_layers': 2, 'ff_dim': 128, 'dropout': 0.5, 'epochs': 20, 'weight_decay':
0.0, 'name': 'C2_Dropout_0.5'}
==================================================

Epoch 1/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 1/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 1/20 | Train Loss: 0.8316 | Train Acc: 0.4951 | Val Loss: 0.7317 | Val
Acc: 0.5065

Epoch 2/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 2/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]
Epoch 2/20 | Train Loss: 0.8596 | Train Acc: 0.4951 | Val Loss: 0.7146 | Val
Acc: 0.5065

Epoch 3/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 3/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 3/20 | Train Loss: 0.8512 | Train Acc: 0.5147 | Val Loss: 0.7045 | Val
Acc: 0.5065

Epoch 4/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 4/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 4/20 | Train Loss: 0.8655 | Train Acc: 0.5049 | Val Loss: 0.7012 | Val
Acc: 0.5065

Epoch 5/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 5/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 5/20 | Train Loss: 0.8512 | Train Acc: 0.4658 | Val Loss: 0.6980 | Val
Acc: 0.5065

Epoch 6/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 6/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 6/20 | Train Loss: 0.7888 | Train Acc: 0.5407 | Val Loss: 0.6965 | Val
Acc: 0.5065

Epoch 7/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 7/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 7/20 | Train Loss: 0.8685 | Train Acc: 0.4886 | Val Loss: 0.6966 | Val
Acc: 0.5065

Epoch 8/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 8/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 8/20 | Train Loss: 0.8576 | Train Acc: 0.4951 | Val Loss: 0.6978 | Val
Acc: 0.5065

Epoch 9/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 9/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 9/20 | Train Loss: 0.8606 | Train Acc: 0.4625 | Val Loss: 0.7012 | Val
Acc: 0.5065

Epoch 10/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 10/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 10/20 | Train Loss: 0.8406 | Train Acc: 0.4723 | Val Loss: 0.6974 | Val
Acc: 0.5065

Epoch 11/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]
Epoch 11/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 11/20 | Train Loss: 0.7990 | Train Acc: 0.5505 | Val Loss: 0.6946 | Val
Acc: 0.5065

Epoch 12/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 12/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 12/20 | Train Loss: 0.7769 | Train Acc: 0.5342 | Val Loss: 0.6946 | Val
Acc: 0.5065

Epoch 13/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 13/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 13/20 | Train Loss: 0.7623 | Train Acc: 0.5570 | Val Loss: 0.6917 | Val
Acc: 0.5065

Epoch 14/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 14/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 14/20 | Train Loss: 0.8006 | Train Acc: 0.4691 | Val Loss: 0.6905 | Val
Acc: 0.5065

Epoch 15/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 15/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 15/20 | Train Loss: 0.7586 | Train Acc: 0.5505 | Val Loss: 0.6906 | Val
Acc: 0.5065

Epoch 16/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 16/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 16/20 | Train Loss: 0.7912 | Train Acc: 0.5016 | Val Loss: 0.6912 | Val
Acc: 0.5065

Epoch 17/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 17/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 17/20 | Train Loss: 0.7514 | Train Acc: 0.5537 | Val Loss: 0.6932 | Val
Acc: 0.5065

Epoch 18/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 18/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 18/20 | Train Loss: 0.8356 | Train Acc: 0.4919 | Val Loss: 0.6964 | Val
Acc: 0.5065

Epoch 19/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 19/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 19/20 | Train Loss: 0.7819 | Train Acc: 0.5114 | Val Loss: 0.6964 | Val
Acc: 0.5065
```

```
Epoch 20/20 Train:   0%|          | 0/10 [00:00<?, ?it/s]

Epoch 20/20 Val  :   0%|          | 0/3 [00:00<?, ?it/s]

Epoch 20/20 | Train Loss: 0.7871 | Train Acc: 0.5081 | Val Loss: 0.6925 | Val
Acc: 0.5065

--- Hasil Eksperimen: C2_Dropout_0.5 ---
Waktu Training Total: 150.39 detik
Final Train Loss: 0.7871
Final Train Acc: 0.5081
Final Val Loss: 0.6925
Final Val Acc: 0.5065
```



```
Grafik disimpan sebagai: hasil_c2_dropout_05_(epochs20,_lr00001,_batch32,_dim64,
_heads4,_layers2,_dropout05).png
==================================================


======================================================================
RINGKASAN EKSPERIMEN BAGIAN C
======================================================================
Nama Eksperimen           | Waktu (detik)   | Val Acc Akhir
----------------------------------------------------------------------
C1_Epochs_50              | 307.06          | 0.8571
C2_Heads_2                | 422.71          | 0.7922
C2_Heads_8                | 406.20          | 0.7532
C2_Layers_1               | 327.46          | 0.6104
C2_Layers_4               | 611.49          | 0.8701
C2_Embed_128              | 642.84          | 0.9221
C2_Embed_256              | 528.87          | 0.9610
C2_Dropout_0.3            | 118.37          | 0.5325
```

```
C2_Dropout_0.5            | 150.39          | 0.5065
```