EE599 - Systems for ML
Phase 2

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Details of the changes:

File name - model.py

1 - class Attention(nn.Module):

Code to be removed:

```
self.cache_k = torch.zeros(
            (
                args.max_batch_size,
                args.max_seq_len,
                self.n_local_kv_heads,
                self.head_dim,
            )
        ).cuda()
 self.cache_v = torch.zeros(
            (
                args.max_batch_size,
                args.max_seq_len,
                self.n_local_kv_heads,
                self.head_dim,
            )
        ).cuda()
```

forward method of attention class

- removed the start_pos from the parameters
- removed the following code

```
        self.cache_k = self.cache_k.to(xq)
        self.cache_v = self.cache_v.to(xq)
```

```
        self.cache_k[:bsz, start_pos : start_pos + seqlen] = xk
        self.cache_v[:bsz, start_pos : start_pos + seqlen] = xv


        keys = self.cache_k[:bsz, : start_pos + seqlen]
        values = self.cache_v[:bsz, : start_pos + seqlen]

        repeat k/v heads if n_kv_heads < n_heads
        keys = repeat_kv(keys, self.n_rep)  # (bs, cache_len + seqlen, n_local_heads,
head_dim)
        values = repeat_kv(values, self.n_rep)  # (bs, cache_len + seqlen,
n_local_heads, head_dim)
```

```
keys = keys.transpose(1, 2) # (bs, n_local_heads, cache_len + seqlen, head_dim)
        values = values.transpose(1, 2) # (bs, n_local_heads, cache_len + seqlen,
head_dim)

        scores = torch.matmul(xq, keys.transpose(2, 3)) / math.sqrt(self.head_dim)
```

- updated the following code using xk, xq, xv

```
xq = xq.transpose(1, 2)  # (bs, n_local_heads, seqlen, head_dim)
xk = xk.transpose(1, 2)  # (bs, n_kv_heads, seqlen, head_dim)  new
xv = xv.transpose(1, 2)  # (bs, n_kv_heads, seqlen, head_dim)  new
```

```
scores = torch.matmul(xq, xk.transpose(2, 3)) / math.sqrt(self.head_dim)
if mask is not None:
            scores = scores + mask  # (bs, n_local_heads, seqlen, cache_len + seqlen)
scores = F.softmax(scores.float(), dim=-1).type_as(xq)
output = torch.matmul(scores, xv)  # (bs, n_local_heads, seqlen, head_dim)
output = output.transpose(1, 2).contiguous().view(bsz, seqlen, -1)
```

2 - class TransformerBlock(nn.Module):

updated the forward method of transformer block

- removed start_pos from function parameters
- updated the parameters while making call to the forward method of attention block (without start_pos)

```
h = x + self.attention.forward(
            self.attention_norm(x), freqs_cis, mask
        )
```

3 - class Llama(Generation):

updated the forward method of the LLama block

- removed start_pos from the function parameters
- updated freq_cis without start_pos

```
freqs_cis = self.freqs_cis[:seqlen]
```

```
for layer in self.layers:
            h = layer(h, freqs_cis, mask)
```

updated above code without start_pos

Apart from these, we can remove the repeat_kv function since it is no longer used.

These are the changes in the model.py

File name - generation.py

We make only one line of change in this

originally:

```
logits = self(tokens[:, prev_pos:cur_pos], prev_pos)
```

updated:

```
logits = self(tokens[:,:cur_pos])
```

Apart from these two files, no other changes are required.
The code is running without bugs and generated outputs according to the original model.

Following are the prompts (no changes made to the ones provided)

```
prompts = [
    # For these prompts, the expected answer is the natural continuation of the prompt

    "I believe the meaning of life is",
    "Simply put, the theory of relativity states that ",
    """A brief message congratulating the team on the launch:

    Hi everyone,

    I just """,
    # Few shot prompt (providing a few examples before asking model to complete more);
    """Translate English to French:

    sea otter => loutre de mer
    peppermint => menthe poivrÃ©e
    plush girafe => girafe peluche
    cheese =>""",
  ]
```

Original Code - With KV Caching Output

```
Singularity> python inference.py
/home1/pakolkar/.local/lib/python3.9/site-packages/torch/__init__.py:696: UserWarning: torch.set_default_tensor_type() is deprecated as
of PyTorch 2.1, please use torch.set_default_dtype() and torch.set_default_device() as alternatives. (Triggered internally at ../torch/c
src/tensor/python_tensor.cpp:451.)
  _C._set_default_tensor_type(t)
I believe the meaning of life is
> to learn to love.
Love is not a feeling. It is a decision.
I believe the meaning of life is to learn to love. Love is not a feeling. It is a decision. It is a commitment. It is a conscious choice
 of the will and the intellect.
There are many

==================================

Simply put, the theory of relativity states that
> 1) the speed of light is constant for all observers and 2) the laws of physics are the same for all observers.
The theory of relativity is a very important concept in physics, but it is also one of the most misunderstood.
There are a lot of misconceptions about

==================================

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        Hi everyone,

        I just
>

        <a href="https://www.google.com">Google</a>

        your website.

        I hope you enjoy the new look and feel.

        I'll be in touch soon to discuss your next project.

        Best

==================================
```

```
Translate English to French:

        sea otter => loutre de mer
        peppermint => menthe poivrée
        plush girafe => girafe peluche
        cheese =>
> fromage
        penguin => pinguin
        handbag => sac à main
        mug => tasse
        toothpaste => dentifrice
        t-shirt => tee-shirt
        pencil => crayon
        parrot => perroquet

==================================
```

Updated Code - Without KV Caching Output

```
Singularity> python inference.py
/home1/pakolkar/.local/lib/python3.9/site-packages/torch/__init__.py:696: UserWarning: torch.set_default_tensor_type() is deprecated as
of PyTorch 2.1, please use torch.set_default_dtype() and torch.set_default_device() as alternatives. (Triggered internally at ../torch/c
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        penguin => pinguin
        handbag => sac à main
        mug => tasse
        chocolate => chocolat
        chocolate => chocolat
        chocolate => chocolat
        chocolate => choc

==================================
```