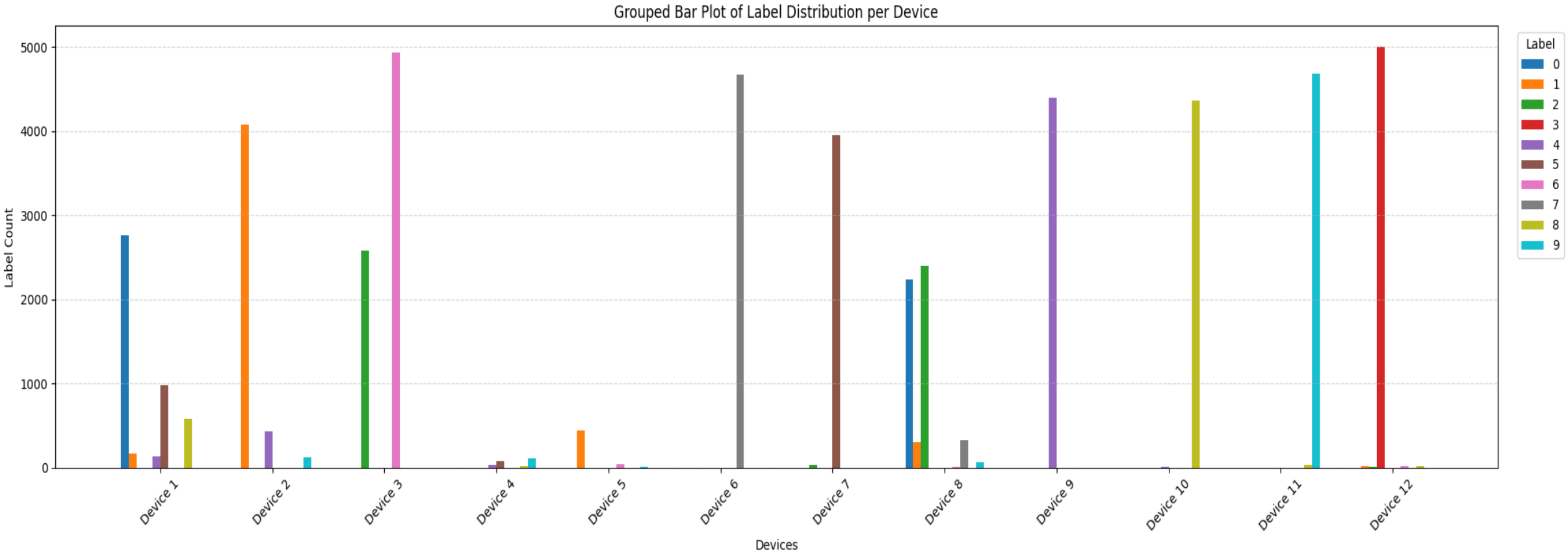
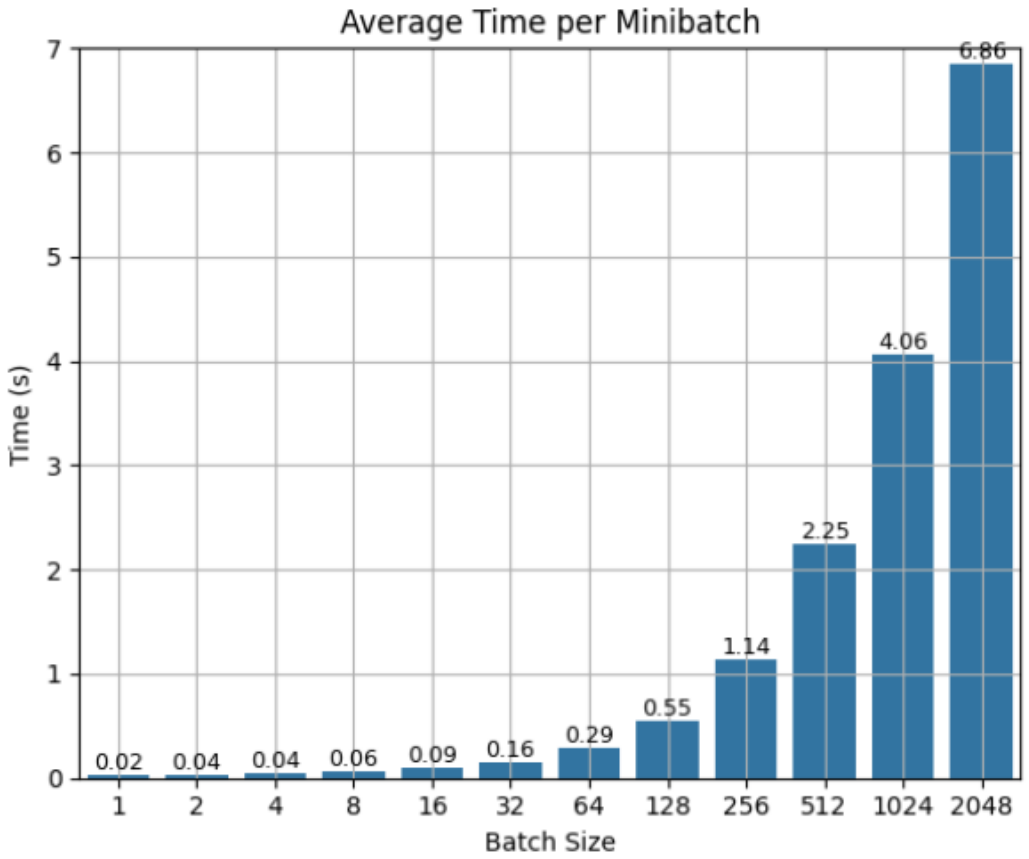
Team Darts

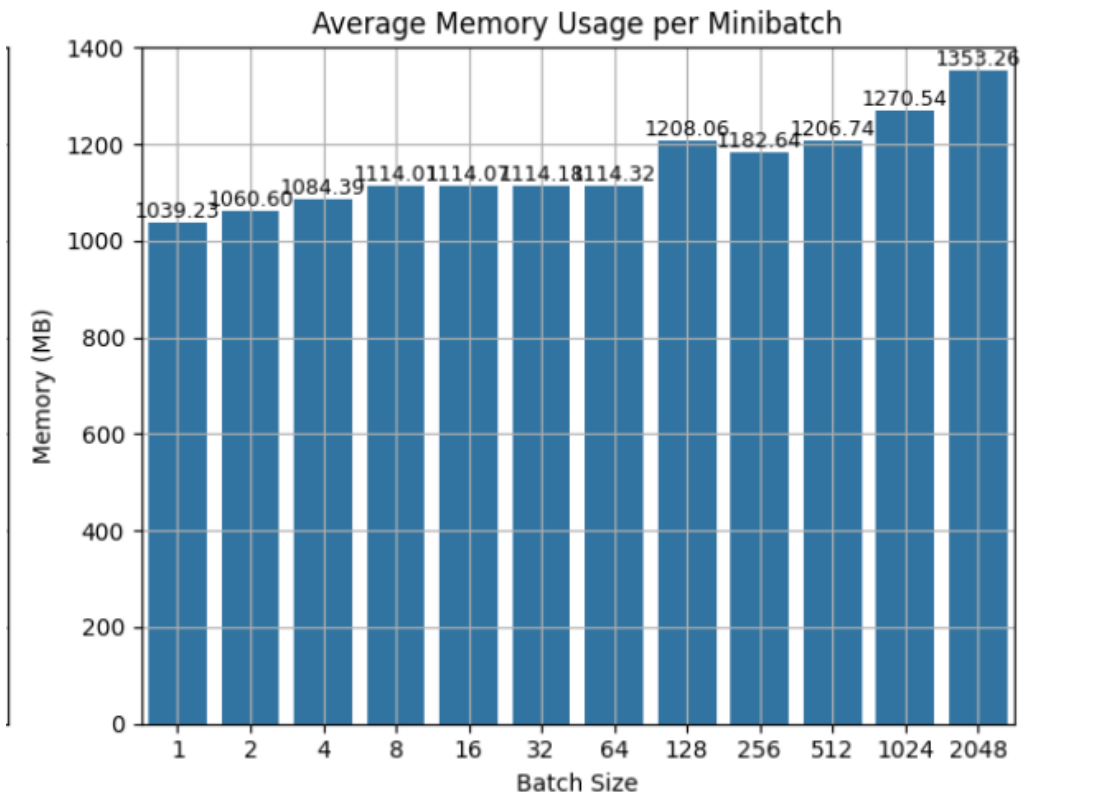
Class Distribution

Class distribution

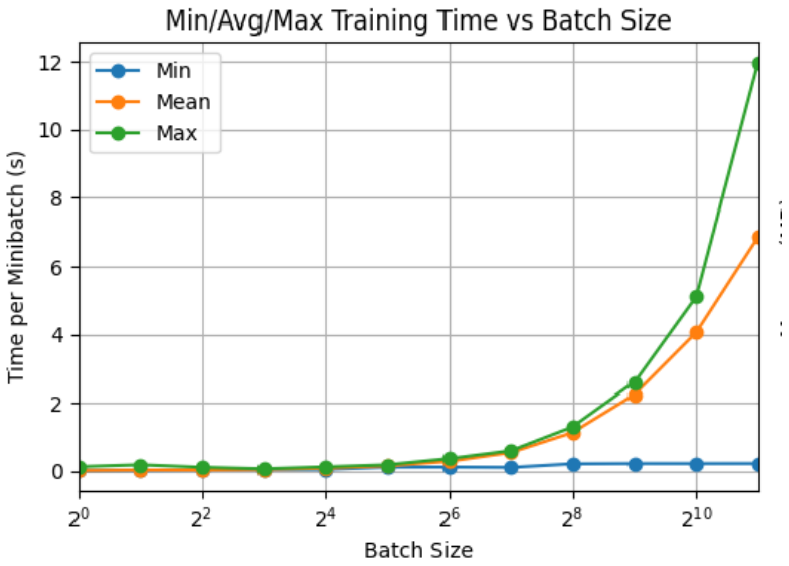


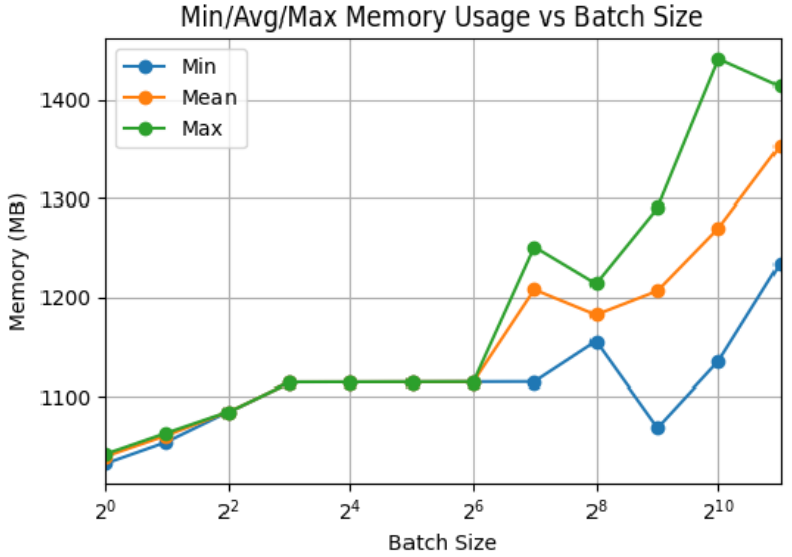
Profiling results with random selection

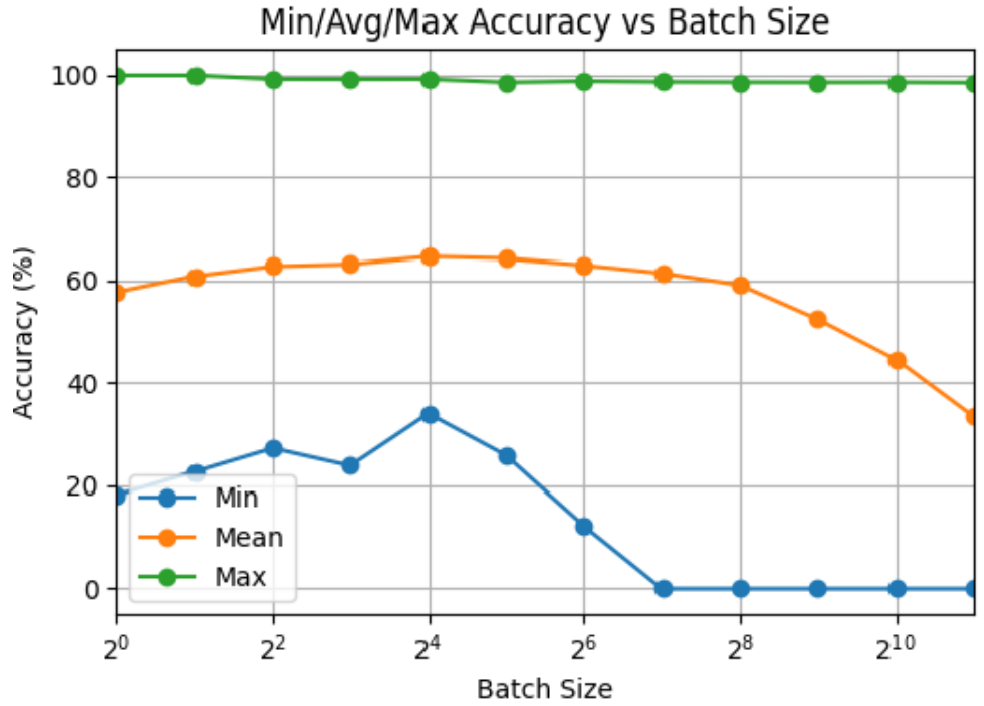




ACCURACY per minibatch for various batch sizes





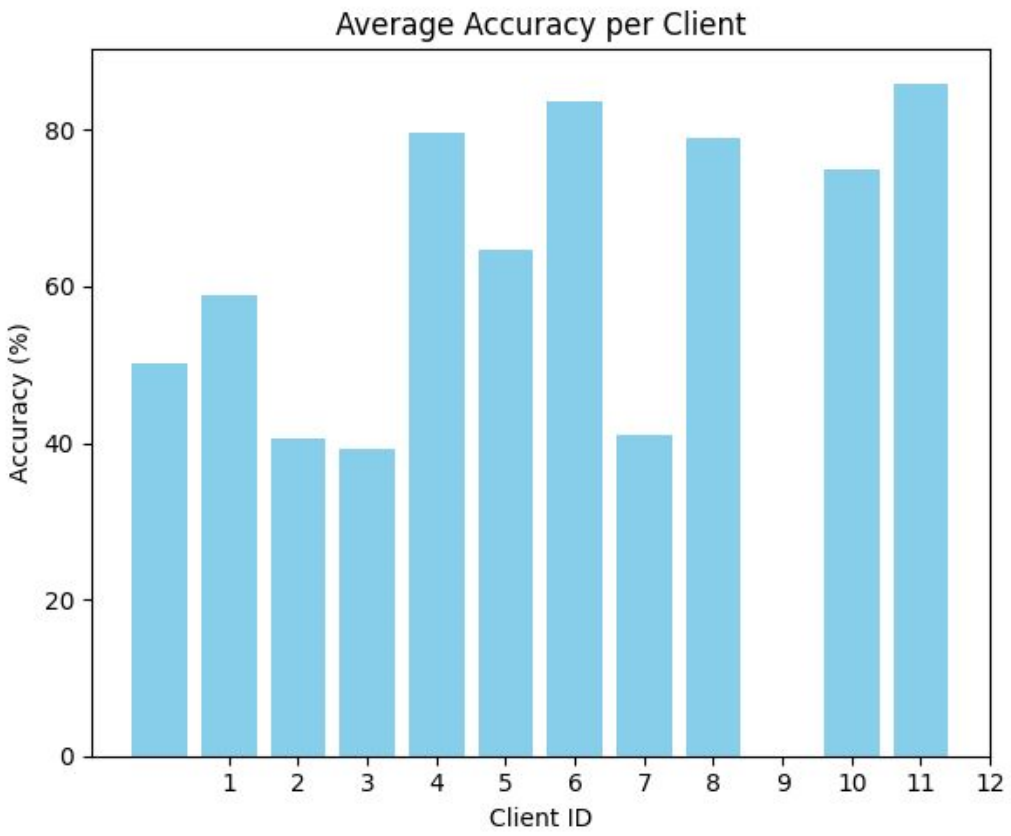


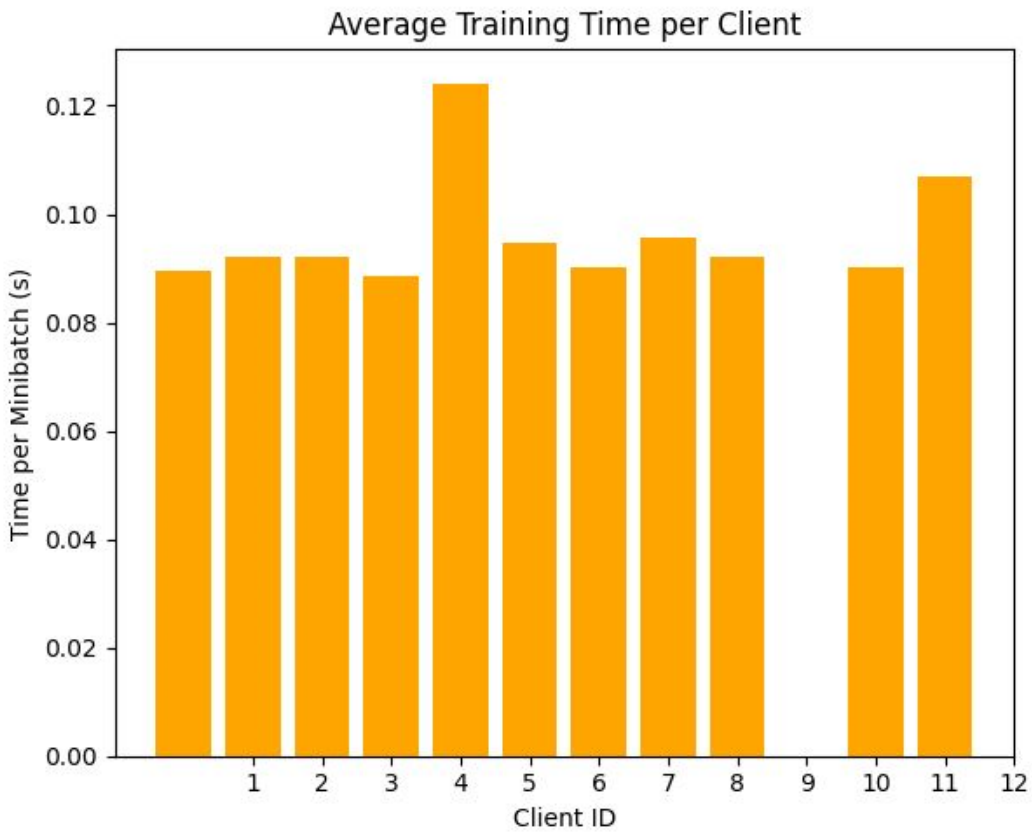
Profiling results with optimal batch size

Optimal batch size - 16

Client ID	#Round	Avg accuracy	Avg loss	Avg time
11	7	85.96	0.6283	0.1070
6	2	83.59	0.5642	0.0901
4	2	79.53	0.8506	0.1242
8	2	79.06	1.0312	0.0921
10	2	74.86	1.5690	0.0902

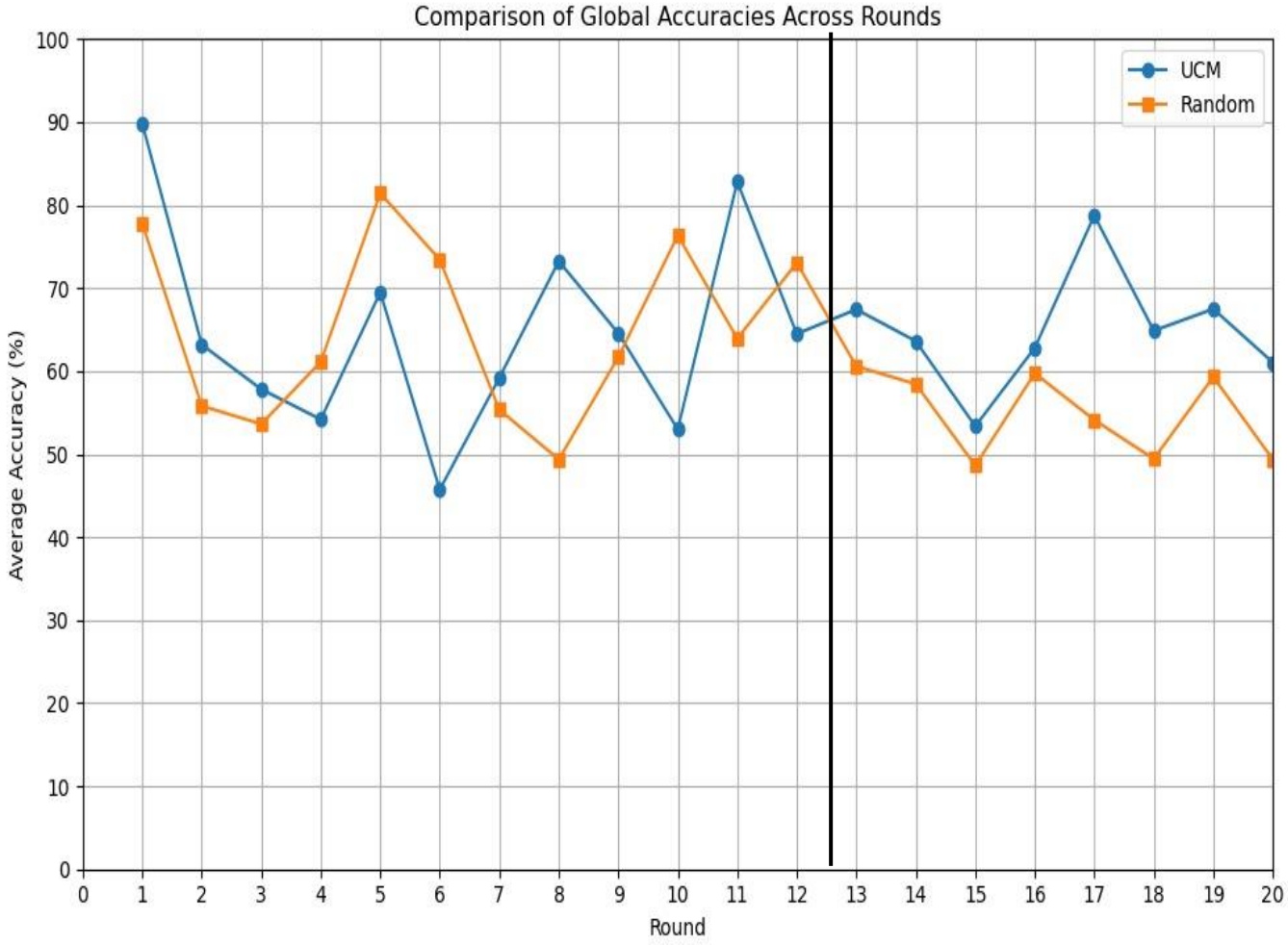
Accuracy & Time plots with optimal batch size





Client selection strategy

- Client selection algorithm: UCB (Upper Confidence Bound)



Algorithm 1 UCB Client Selection with ϵ-Greedy and Initial Random Rounds

Input:
  Client list $\mathcal{C} = \{c_1, c_2, \ldots, c_N\}$ with client IDs $\{0, 1, \ldots, N-1\}$, where N is the total number of clients
  Round number $t \in \{1, 2, \ldots, T\}$
  Number of clients to select per round k
  Exploration parameter $c > 0$
  ϵ-greedy probability $\epsilon \in [0, 1]$
  Number of initial random rounds R_{init}
Initialization:
  For each client $i \in \{0, 1, \ldots, N-1\}$:
    $n_i \leftarrow 0$ ▷ Number of selections for client i
    $r_i \leftarrow []$ ▷ List of rewards for client i
if $t \leq R_{\text{init}}$ or random$(0, 1) < \epsilon$ **then** ▷ Random selection for initial rounds or ϵ-greedy
  Select k clients uniformly at random from $\mathcal{C}$ without replacement
  Update $n_i \leftarrow n_i + 1$ for each selected client i
  return Selected client IDs
end if
UCB Selection:
Compute total selections $s \leftarrow \sum_{i=0}^{N-1} n_i + 10^{-10}$ ▷ Avoid division by zero
for each client $i \in \{0, 1, \ldots, N-1\}$ **do**
  if r_i is empty **then** ▷ Client has no rewards yet
    $\bar{r}_i \leftarrow 0$ ▷ Set average reward to 0
  else
    $\bar{r}_i \leftarrow \frac{\sum_{r \in r_i} r}{|r_i|}$ ▷ Compute average reward
  end if
  $n_i' \leftarrow n_i + 10^{-10}$ ▷ Small epsilon to avoid division by zero
  $\text{UCB}_i \leftarrow \bar{r}_i + c\sqrt{\frac{\ln(s)}{n_i'}}$ ▷ Compute UCB score
end for
Select k clients with the highest UCB_i values
Update $n_i \leftarrow n_i + 1$ for each selected client i
return Selected client IDs

Results and takeaways

Round	UCM Accuracy	Random Accuracy
1	89.81%	77.81%
10	53.00%	76.37%
20	61.05%	49.38%

Benefits:

- Faster Convergence:
- Greater Resource Efficiency
- Potentially Higher Accuracy:
- Adaptive Selection

Trade offs:

- Increased Server Complexity
- Risk of Fairness Bias