BUILDING A GOOD CACHE BY COMBINING THE INITIAL SEGMENTS OF TWO LISTS

\[ |T_1| + |T_2| = C \]

ARCLING: HEURISTIC FOR SETTING A GOAL COMBINATION
- NO REFETCHING
  - ADJUST CACHE TOWARDS GOAL
- W. REFETCHING
  - SET CURRENT CACHE TO GOAL

RELATIVE LOSS BOUNDS

\[ M_{\text{alg}}(S) \leq \alpha M^*(S) + \text{SMALL ADDITIONAL TERMS} \]

IDEALLY 1
ONE EXPERT PER COMBINED CACHE

Loses ∈ {0,13} Hit or Miss

Problem:
- How do we produce a cache from the weight vector over experts?
- Can't use weighted average $\bar{\bar{w}}, \bar{x}$

↑ Binary, only available after request
n+1 WEIGHTS \( w_0, \ldots, w_n \) ON GAPS

IDEA 1: \( \tilde{y}_t = \sum_{i=0}^{n} w_{t,i} \cdot i \) MEAN

- Why \( i \)

- WHEN MISS, NEED TO HALF OF TOTAL WEIGHT BY \( \beta = e^{-\alpha} \)

\[ w_0 \quad w_1 \quad w_2 \quad w_3 \quad w_4 \ldots \quad w_n \]

\[ 0 \quad 2 \quad 3 \quad 4 \quad n \]

MEAN \( \alpha = \sum_{i=0}^{n} w_{i} \cdot i \)

LEFT TOTAL

RIGHT TOTAL

\[ \text{NOT NECESSARILY} \]

\[ 50\% \quad 50\% \]

SPLIT
CAN THIS BE FIXED?
DIFFERENT POTENTIAL?

IDEA 2: PREDICT W. WEIGHTED MEDIAN

WEIGHT

WEIGHTS ON GAPS OF LEFT LIST

\[ w_0 \cdot w_1 \cdot w_2 \cdot \cdots \cdot w_{i-1} \cdot w_i \cdot w_{i+1} \cdots w_{n-1} \cdot w_n \]

WEIGHS ON GAPS

\( \Rightarrow \frac{1}{2} \)

\( \Rightarrow \frac{1}{2} \)

MEAN

\( n = 10 \)

Either MEDIAN UPWARDS
or DOWNWARDS MULTIPLIED BY \( \frac{1}{5} \)

BOUNDS WORK FINE FOR DET. CASE

\[ M \leq 2 M^* + O(\sqrt{\frac{M^*}{n}} + \frac{1}{n}) \]

IDEALLY MEDIAN DOES NOT MOVE TOO FAST?
RANDOMIZED HEDGE ALG:
- \( i \sim w_i \)
- CONSTANT OF \( 1 \) IN FRONT OF \( M^k \)
- TOO MUCH REFETCHING

OPEN: IS CONSTANT OF \( 1 \) POSSIBLE
W. NO REFETCHING, I.E.

\[
E(M_A) \leq 1 \cdot M^k + O \left( \sqrt{M^k \ln n^2 + \epsilon n u} \right)
\]

\( k \) LISTS D

\[
\sum_i \text{INITIAL SEGNI} = n
\]

\( O(u^{u-1}) \) EXPERTS

HEDGE ALG. W. ONE WEIGHT PER COMPOSITE CACHE
- DYNAMIC PROGR. \( O(k u^2) \)
- FANCY \( O(k u \ln u) \)
- TOO MUCH REFETCHING
- EACH LIST PROVIDES TIME
  FOR ANY DETERM. ALG) \# MISSES CAN BE \( \geq k \cdot M^k \)