

Ahmet Ulucay Drag-and-Carry Multiplication Algorithm (AUD&CMA)

Abstract:

The Ahmet Ulucay Drag-and-Carry Multiplication Algorithm (AUD&CMA) is a digit-based multiplication technique that decomposes any base-10 multiplication into a series of digit-wise scalar multiplications, symmetrical zero-padding, sliding-window summation, and a specialized carry-forward mechanism. The leftmost digit is preserved in its complete form while all others are reduced to single digits through a cascading carry operation.

1. Technical Field

This algorithm relates to the field of arithmetic computation, digital signal processing, and efficient multiplication techniques suitable for low-complexity processors, educational tools, and novel computing architectures.

2. Background

Traditional long multiplication or Karatsuba's algorithm involves complex digit placement and recursive logic. AUD&CMA simplifies this by using consistent padding and a structured window summation, offering advantages in clarity, implementation, and pedagogical use.

3. Summary of the Invention

The invention introduces:

- A digit-wise multiplication method
- Zero-padding based on a digit-length parameter k
- A sliding window of size k across a padded digit list
- A drag-and-carry mechanism that enforces single-digit output except at the leftmost position

4. Algorithm Description

Inputs:

- n : an integer number to be multiplied

- b: a multiplier composed of repeated digits (e.g., 222)
- k: digit-length of b (inferred or given)
- m: base multiplier such that $b = m \times 111\dots 1$ (k times)

Process:

1. Decompose n into digits and multiply each by m
2. Pad (k-1) zeros on both left and right
3. Slide a window of size k across the padded list
4. Sum each window to get intermediate results
5. Apply drag-and-carry from right to left, preserving the leftmost digit in full form
6. Flatten final values to obtain output number

Output:

A base-10 number representing the product $n \times b$.

5. Example

Example: $n = 547$, $b = 222 \rightarrow k = 3$, $m = 2$

1. $[5, 4, 7] \times 2 = [10, 8, 14]$
2. Padded: $[0, 0, 10, 8, 14, 0, 0]$
3. Windows: $[10, 18, 32, 22, 14]$
4. Carry: $[12, 1, 4, 3, 4] \rightarrow 121434$