Algorithm 1 Multi-objective GP using the Transient Terminal Set

Input: population size ρ, crossover probability p_c, mutation probability p_m, transient mutation probability p_d, terminal set T, function set F, death age α

Define: generation G_n, individual fitness f_i, transient terminal set M_{G_n}, fitness threshold f_{t,G_n}

Initialize starting population P_{G_0}, $M_{G_0} \leftarrow \emptyset$, $f_{t,G_0} \leftarrow 0$
while *no improvement in* $\max f_i \in P_{G_n}$ *since* $P_{G_{n-5}}$ **do** ▷ Evolve generation G_{n+1}
  $P_{G_{n+1}} \leftarrow \emptyset$, $M_{G_{n+1}} \leftarrow M_{G_n}$
  while len$P_{G_{n+1}} \neq \rho$ **do** ▷ Update population $P_{G_{n+1}}$
    Perform crossover $\forall i \in P_{G_n}$ with p_c
    Perform mutation $\forall i \in P_{G_n}$ with p_m, T, F
    Perform transient mutation $\forall i \in P_{G_n}$ with p_d, M_{G_n}
    $P_{G_{n+1}} \leftarrow P_{G_{n+1}} \cup \{i | i_{offspring}\}$
  for all subtree $s \in M_{G_{n+1}}$ **do** ▷ Update transient terminal set $M_{G_{n+1}}$
    if $age(s) > \alpha$ **then**
      Prune s from $M_{G_{n+1}}$
  Compute f_{t,G_n} from $\forall f_i \in P_{G_{n+1}}$
  for $i \in P_{G_{n+1}}$ **do**
    $f_c \leftarrow \Delta f_i$ from G_n to G_{n+1}
    if $f_c > f_{t,G_n}$ **then**
      $M_{G_{n+1}} \leftarrow M_{G_{n+1}} \cup \{$subtree $s \in i\}$

Note: The transient terminal set is utilized during a genetic operation called *transient mutation*, in which a candidate solution is mutated with a member of the set. The transient terminal set is composed of subtrees generated in the population (either through crossover or normal mutation) which have resulted in substantial increases in the fitness of candidate solutions.

The algorithm above seeks to improve the interpretability of Symbolic Regression models via the use of multi-objective GP and the proposed transient terminal set by improving the search process itself. By utilizing a complexity measure in addition to an error measure as the Pareto-efficient objectives for the algorithm, and pairing this with the proposed transient terminal set, it is theorized that candidate solutions will become less complex when compared with standard multi-objective GP. As the selection process for the transient terminal set follows this multi-objective framework, improvements in either objective will result in a candidate solution's altered subtree being added to the set. Thus, the transient terminal set distributes proven subtrees which result in lower errors and/or complexities throughout the population. This process potentially results in candidate solutions with both minimized error and complexity measures, and is a improvement from the entirely random mutation of standard multi-objective GP.