

Algorithm for Random Forest Attack

```

initialize x_stack, push x
initialize directions, default to zeros
initialize paths_stack

for i in range(MAX_ITERATIONS):
    if prediction(x_stack.peek()) != y:
        return x_stack.peek()

    while budget > 0:
        find paths given x_stack.peek()
        find a viable node with least cost using the paths
        if node is None:
            break

        compute next_x given the selected node
        x_stack.push(next_x)
        reduce budget
        update directions
        set the node as visited
        paths_stack.push(paths)

        if prediction(x_stack.peek()) != y:
            return x_stack.peek()

    x_stack.pop()
    restore directions
    refund budget

    find a viable node with least cost using paths_stack.peek()
    while node is None:
        paths_stack.pop()
        x_stack.pop()
        restore directions
        refund budget
        find a viable node with least cost using paths_stack.peek()

    compute next_x given the selected node
    x_stack.push(next_x)
    reduce budget
    update directions
    set the node as visited

```

Parameters

- Inputs:
 - k: Number of Decision Trees in a RF

- m: Number of input features
- x: (1*m Array) An input example
- y: (int) Output label
- model: A trained Random Forest model which contains k Decision Trees
- budget: (float) Maximum perturbation (Default=0.2*m)
- MAX_ITERATIONS: The maximum number of iterations (Default=100)
- Outputs:
 - X_adv: (1*m Array) Adversarial example
- Parameters:
 - x_stack: LIFO stack. Keeps tracking the updates of x
 - directions: Which direction can x updates to (-1: Negative only, 0: Both, 1: Positive only)
 - paths_stack: LIFO stack. Keeps tracking the selected paths with given x

Pseudocode Version 2

```

initialize x_stack, push x
initialize directions, default to zeros
compute the initial paths
initialize paths_stack, push initial paths

for i in range(MAX_ITERATIONS):
    if prediction(x_stack.peek) != y:
        return x_stack.peek

    find path from the last node in paths_stack
    if no node is available at the root:
        break

    while path is None or budget < 0:
        if x_stack is not at root:
            last_x = x_stack.pop
            paths_stack.pop
        else:
            last_x = x

        restore directions
        refund budget
        find path from the last node in paths_stack

    compute next_x given the selected path
    x_stack.push(next_x)
    reduce budget
    update directions
    set the node in the selected path as visited
    compute new paths
    paths_stack.push(paths)

```