**Algorithm 3** Incremental tensor singular value decomposition, $(S,\ [U,\ \Sigma,\ V]_{new}) = I - TSvd(\chi,\ T,\ [U,\ \Sigma,\ V]_{initial})$.

**Input:**

New tensor $\chi \in R^{I_1 \times I_2 \times ... \times I_N}$.

Previous tensor $T \in R^{I_1 \times I_2 \times ... \times I_N}$.

Previous unfolded matrices SVD results $[U,\ \Sigma,\ V]_{initial}$.

**Output:**

New truncated SVD results $[U,\ \Sigma,\ V]_{new}$.

New core tensor $S$.

1: Extend tensor $\chi$ and tensor $T$ to identical dimensionality.
2: Unfold new tensor $\chi$ to matrices $\chi_{(1)}, ..., \chi_{(N)}$.
3: Call algorithm $R - MSvd$ to update above unfolded matrices.
4: Truncate the new orthogonal bases.
5: Combine new tensor $\chi$ with initial tensor $T$.
6: Obtain new core tensor $S$ with $n$-mode product.
7: **return** $S$, and $[U,\ \Sigma,\ V]_{new}$.