# MTLTS: A Multi-Task Framework To Obtain Trustworthy Summaries From Crisis-Related Microblogs

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## Trustworthy Disaster Summarization

Given large volumes of crisis-related tweets posted during the unfolding of sudden adversities, the task is to generate *trustworthy* and actionable summaries.



**Paris Terror Attack (October 2020)**

**T1:** The Muslim who beheaded a teacher in a street in France waited outside the school and asked pupils to identify his target, anti-terrorism officials say. – **0.91**

**T2:** In an horrific attack outside Paris a teacher having taught a class about 'Freedom of Expression' beheaded by an 18yr old student, a Chechen, born in Moscow who filmed his attack before being shot dead by police at the scene! 9 people arrested include his family members! <link> – **0.86**

**T3:** The teacher brutally murdered for doing his job in France yesterday has been named as 47-year-old Samuel Paty. <link> – **0.81**

Joint score representing the verifiability or authenticity and summary-worthiness of tweets that are included in the summary.

### Our Goals

- To design an end-to-end solution for **trustworthy summarization** of disaster-related tweets.
- To take a **supervised** approach as against existing disaster-specific summarization algorithms.
- To address the gap between a vast body of literature on document summarization and comparatively limited research on social media summarization.

## MTLTS Architecture

**MTLTS** is a hierarchical multi-task learning based solution for trustworthy summarization. The **verifier** is trained at a lower layer and its predictions are used to train the **summarizer** at a deeper layer for obtaining the summary-worthiness of tweets.
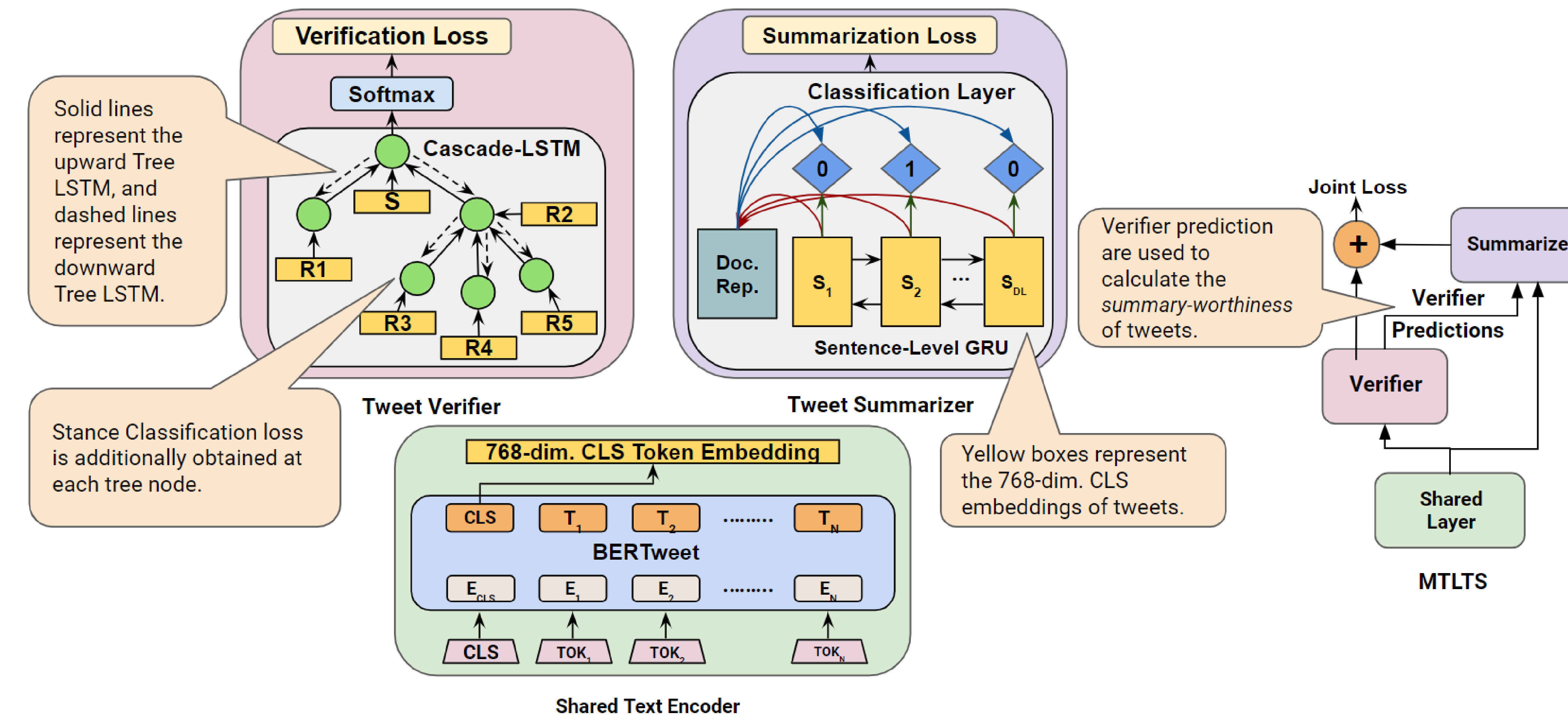


## Summary Evaluation and Comparison

| Model | Charliehebdo | | Germanwings | | Ottawa | | Sydney | | Overall | |
|---|---|---|---|---|---|---|---|---|---|---|
| | V-Ratio | R1-F1 | V-Ratio | R1-F1 | V-Ratio | R1-F1 | V-Ratio | R1-F1 | V-Ratio | R1-F1 |
| APSAL | 0.200 | **0.493** | 0.056 | 0.437 | 0.000 | 0.435 | 0.000 | 0.483 | 0.064 | 0.462 |
| COWTS | 0.385 | 0.479 | 0.111 | 0.504 | 0.118 | 0.427 | 0.087 | 0.479 | 0.175 | 0.472 |
| SCC | 0.365 | 0.465 | 0.244 | 0.505 | 0.212 | 0.444 | 0.308 | 0.492 | 0.282 | 0.477 |
| VERISUMM | 0.722 | 0.381 | 0.624 | 0.519 | 0.645 | 0.396 | 0.619 | 0.378 | 0.653 | 0.419 |
| MTLTS ($\kappa = 1$) | 0.750 | 0.444 | 0.927 | 0.565 | **0.860** | **0.477** | 0.627 | **0.518** | 0.791 | **0.501** |
| MTLTS ($\kappa = 0$) | **0.947** | 0.472 | **1.000** | **0.575** | 0.834 | 0.464 | **0.750** | 0.452 | **0.883** | 0.491 |

Figure: Quantitative comparison of summaries generated by various methods on the *PHEME* dataset. *V-Ratio*: Verified Ratio of summary tweets.

**Baselines:**
- *APSAL*: A clustering-based multi-document summarization system for disaster-related articles.
- *COWTS*: An extractive summarization approach to generate situational summaries from disaster-related tweets.
- *SCC*: An extractive summarization approach to identify sub-events from disaster-related tweets, and summarize them.
- *VERISUMM*: A 2-stage pipeline approach to verify and summarize disaster-related tweets.

## Tweet Credibility Verification Results

| Model | Accuracy | Precision | Recall | F1-Macro |
|---|---|---|---|---|
| CETM-TL | 0.727 | 0.715 | 0.693 | 0.704 |
| TD-RvNN | 0.737 | 0.748 | 0.738 | 0.743 |
| TL-Conv | 0.740 | 0.743 | 0.747 | 0.745 |
| VRoC | 0.752 | 0.755 | 0.752 | 0.752 |
| Cascade-LSTM | 0.768 | 0.762 | 0.756 | 0.759 |
| MTLV | **0.786** | **0.770** | **0.766** | **0.768** |

Figure: Comparison of Rumour Detection/Tweet Verification results, averaged across all four train/test splits over the *PHEME* dataset.

- *CETM-TL*, *TD-RvNN*, and *TL-Conv* are three different tree-based rumour classifiers. *TL-Conv* jointly trains stance classification along with rumour detection.
- *VRoC*: A variational autoencoder-based multi-task rumour classifier.
- *Cascade-LSTM*: A novel bi-directional variant of Tree-LSTM to accumulate the knowledge from the entire information cascade at each tree node.

Additional analysis results are available in the paper.

## Key Highlights

- MTLTS is the first end-to-end solution for obtaining trustworthy and actionable summaries from potentially rumourous tweets posted during sudden crises.
- Taking a supervised approach enhances the generalizability of our solution to unseen events.
- A novel method is presented to leverage a document summarizer for summarizing social media posts.
- We achieve state-of-the-art results both for the primary task of trustworthy summarization as well as the auxiliary task of tweet credibility verification.
- We discover that the veracity of different classes of tweets change over time in different proportions as official details are gradually made public.

## For Further Information

Preprint: https://arxiv.org/pdf/2112.05798.pdf
Github: https://github.com/rajdeep345/MTLTS