

Multi-Task Temporal and Spatial Networks for High-Precision Event Spotting in Volleyball Videos

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Abstract: Understanding the precise timing and location of events is crucial for analyzing sports videos, especially in fast-paced sports like volleyball. We introduce a new task: high-precision spatial-temporal event spotting, which aims to detect both when and where key actions occur. To support this, we present the KOVO Volleyball Event Dataset, featuring 947 rally videos, 890,797 frames, and 5,935 events, annotated for both temporal and spatial localization. Our best model achieves a temporal mAP of 90.59, a spatial mAP of 77.94, and a combined mAP of 85.46 across various temporal and spatial thresholds. Notably, we find that incorporating spatial predictions enhances mAP by 10%, underscoring the synergy between spatial and temporal analysis. To the best of our knowledge, this is the first work addressing this task, establishing a strong baseline for future research in spatial-temporal event spotting.

1 INTRODUCTION

Your paper will be part of the conference proceedings therefore we ask that authors follow the guidelines explained in this example in order to achieve the highest quality possible (Smith, 1998).

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2 RELATED WORK

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Group 1. To format your paper you will need to copy into your working directory, but NOT edit, the following 4 files:


- apalike.bst
- apalike.sty
- article.cls
- scitepress.sty


Group 2. Additionally, you may wish to copy and edit the following 3 example files:


- example.bib
- example.tex
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2.2 Page Setup

The paper size must be set to A4 (210x297 mm). The document margins must be the following:

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This section must be in one column.

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Use the command `\title` and follow the given structure in "example.tex". The title and subtitle must be with initial letters capitalized (titlecased). The separation between the title and subtitle is done by adding a colon ":" just before the subtitle beginning. In the title or subtitle, words like "is", "or", "then", etc. should not be capitalized unless they are the first word of the title or subtitle. No formulas or special characters of any form or language are allowed in the title or subtitle.

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Use the command `\keywords` and follow the given structure in "example.tex". Each paper must have at least one keyword. If more than one is specified, please use a comma as a separator. The sentence must end with a period.

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Files "example.tex" and "example.bib" show how to create a paper with a corresponding list of references.

This section must be in two columns.

Each column must be 7,5-centimeter wide with a column spacing of 0,8-centimeter.

The section text must be set to 10-point.

Section, subsection and sub-subsection first paragraph should not have the first line indent.

To remove the paragraph indentation (only necessary for the sections), use the command `\noindent` before the paragraph first word.

If you use other style files (.sty) you MUST include them in the final manuscript zip file.

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The heading of a section title should be in all-capitals.

Example: `\section{FIRST TITLE}`

2.4.2 Subsection Titles

The heading of a subsection title must be with initial letters capitalized (titlecased).

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Example: `\subsection{First Subtitle}`

2.4.3 Sub-Subsection Titles

The heading of a sub subsection title should be with initial letters capitalized (titlecased).

Words like "is", "or", "then", etc should not be capitalized unless they are the first word of the sub subsection title.

Example: `\subsubsection{First Subsubtitle}`

2.4.4 Tables

Tables must appear inside the designated margins or they may span the two columns.

Tables in two columns must be positioned at the top or bottom of the page within the given margins. To span a table in two columns please add an asterisk (*) to the table *begin* and *end* command.

Example: `\begin{table*}`
`\end{table*}`

Tables should be centered and should always have a caption positioned above it. The font size to use is 9-point. No bold or italic font style should be used.

The final sentence of a caption should end with a period.

Table 1: This caption has one line so it is centered.

Example column 1	Example column 2
Example text 1	Example text 2

Please note that the word "Table" is spelled out.

Table 2: This caption has more than one line so it has to be justified.

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Figure 2: This caption has more than one line so it has to be justified.

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Equations should be placed on a separate line, numbered and centered.

The numbers accorded to equations should appear in consecutive order inside each section or within the contribution, with the number enclosed in brackets and justified to the right, starting with the number 1.

Example:

$$a = b + c \quad (1)$$

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Algorithms and Listings captions should have font size 9-point, no bold or italic font style should be used and the final sentence of a caption should end with a period. The separator between the title of algorithms/listings and the name of the algorithm/listing must be a colon. Captions with one line should be centered and if it has more than one line it should be set to justified.

Data: this text

Result: how to write algorithm with L^AT_EX2e initialization;

while *not at end of this document* **do**

 read current;

if *understand* **then**

 go to next section;

 current section becomes this one;

else

 go back to the beginning of current section;

end

end

Algorithm 1: How to write algorithms.

2.4.8 Program Code

Program listing or program commands in text should be set in typewriter form such as Courier New.

Example of a Computer Program in Pascal:

```
Begin
    Writeln('Hello World!!');
End.
```

The text must be aligned to the left and in 9-point type.

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References and citations should follow the APA (Author, date) System Convention (see the References section in the compiled manuscript). As example you may consider the citation (Smith, 1998). Besides that, all references should be cited in the text. No numbers with or without brackets should be used to list the references.

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ACKNOWLEDGEMENTS

If any, should be placed before the references section without numbering. To do so please use the following command:

REFERENCES

Moore, R. and Lopes, J. (1999). Paper templates. In *TEMPLATE'06, 1st International Conference on Template Production*. SCITEPRESS.

Smith, J. (1998). *The Book*. The publishing company, London, 2nd edition.

APPENDIX

If any, the appendix should appear directly after the references without numbering, and not on a new page.