CNN-based fast source device identification: supplementary materials

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***Abstract*—In this document, we report additional materials about our main paper on fast source device identification by means of convolutional neural networks (CNNs). Specifically, we exploit the BOSARIS Toolkit to generate more detailed results for the open-set problem, i.e., tackling source identification in case of *unknown* cameras. Results depict the receiver operating characteristic (ROC) curves and the detection error trade-off (DET) curves for each experiment. Moreover, we report the equal error rate (EER), the mininum cllr and the minimum DCF point of each curve.**

I. Open-set results

We resort to Bosaris Toolkit [1] to generate a complete overview of the open-set results achieved during our experimental campaign. Precisely, the following figures expand Fig. 4 reported in the original paper. Indeed, in Fig. 4, any value of accuracy $\mathrm{AUC}_{\mathrm{os}}$ reports a compact evaluation metrics for the actual receiver operating characteristic (ROC) curve of the problem, which draws the relationship between true positive rate (TPR) and false positive rate (FPR). In the following lines, we show all the ROC curves that have been merged in Fig. 4.

Moreover, as suggested by [2], we also plot the detection error trade-off (DET) curves, which describe false positive rate (typically defined as false alarm rate) versus missed detection rate. Contrarily to ROC curves, DET curves are very useful to better distinguish different well performing strategies [2].

In addition to the curves, we show other compact metrics which can be useful to better evaluate the results. Specifically, we report the equal error rate (EER), the minimum cllr and the mininum DCF point of each curve. Given that these metrics are very well defined in the user guide of [1], for brevity's sake we do not provide theoretical definitions in this document. However, we refer the interested reader to [1], where a complete and thorough explanation of all these metrics is provided.

In order to give the possibility to catch even the smallest details of the shown Figures, we report at this link [1] a complete list of the MATLAB ".fig" files used to generate these materials.

A. ROC curves

Fig. 3 reports all the ROC curves achieved for any network configuration and patch-size. The higher the curve, the more correct the detection.

B. DET curves

Fig. 4 reports all the DET curves achieved for any network configuration and patch-size. Each DET curve is associated to a minDCF point, drawn by means of the function `fast_minDCF.m` provided in [1]. To compute the minDCF point of the curve, we suppose to have equal cost of missed detections and false alarms and a target prior of 0.5. Both DET curve and minDCF point are useful to evaluate the goodness of the scores returned by the system.

C. Equal Error Rate

Fig. 1 reports the equal error rate (EER) related to each ROC curve. EER values are computed using the function `rocch2eer.m` provided in [1]. The lower the EER, the better the detection.

D. Minimum cllr

Fig. 2 reports the minimum cllr value related to each patch-size. It has been drawn by means of the function `min_cllr.m` of [1]. As the EER, the lower the value of the minimum cllr, the better the detection.

References

[1] "BOSARIS Toolkit," https://sites.google.com/site/bosaristoolkit/home.

[2] A. Martin, G. Doddington, T. Kamm, M. Ordowski, and M. Przybocki, "The DET curve in assessment of detection task performance," *National Inst of Standards and Technology Gaithersburg MD*, 1997.

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[1] https://github.com/polimi-ispl/cnn-fast-sdi

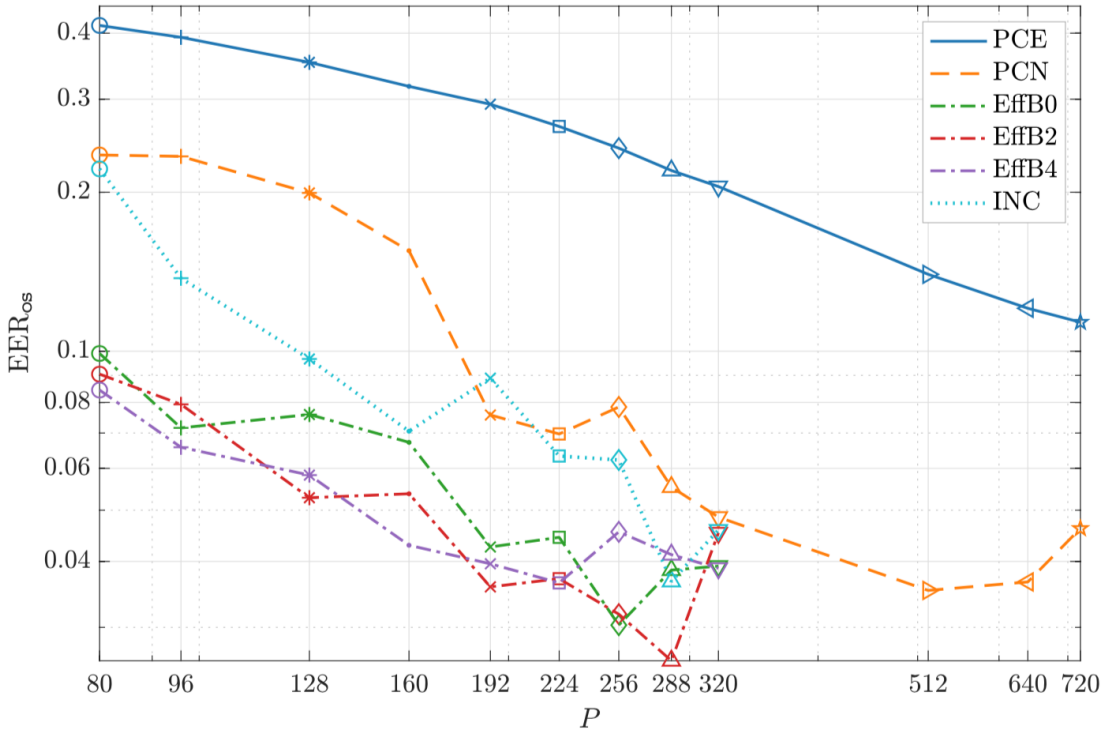

Fig. 1. Equal Error Rate of ROC curves as a function of crop size P.

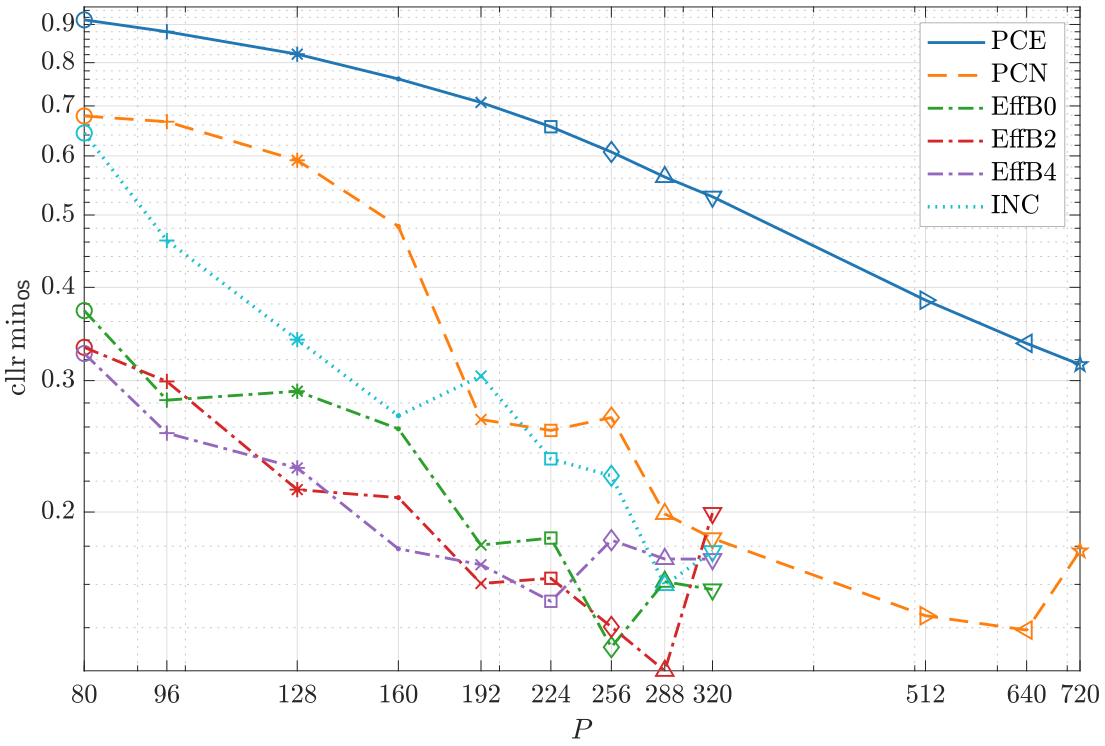

Fig. 2. Minimum value of cllr measure as a function of crop size P.

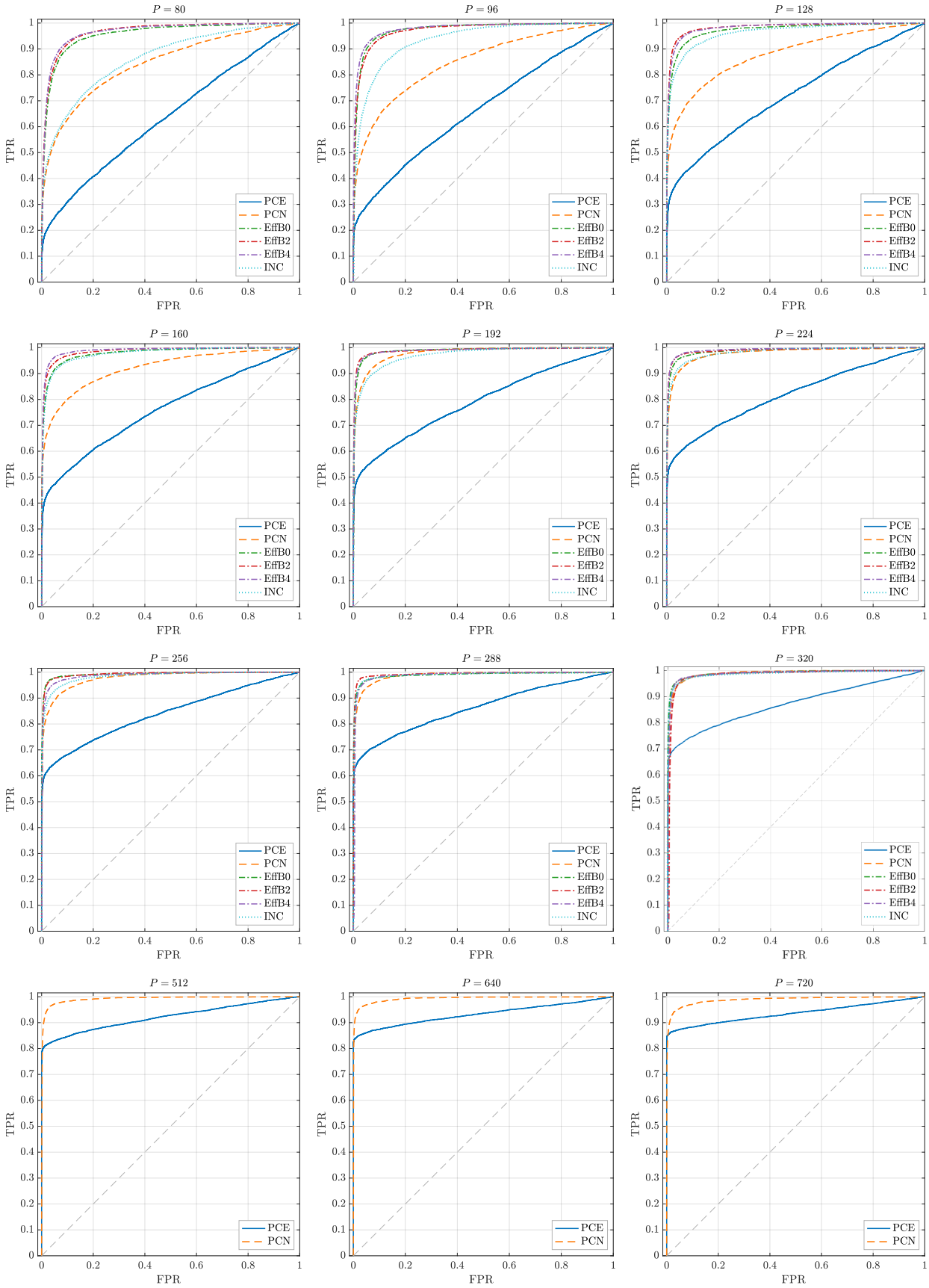

Fig. 3. ROC curves as a function of crop size P.

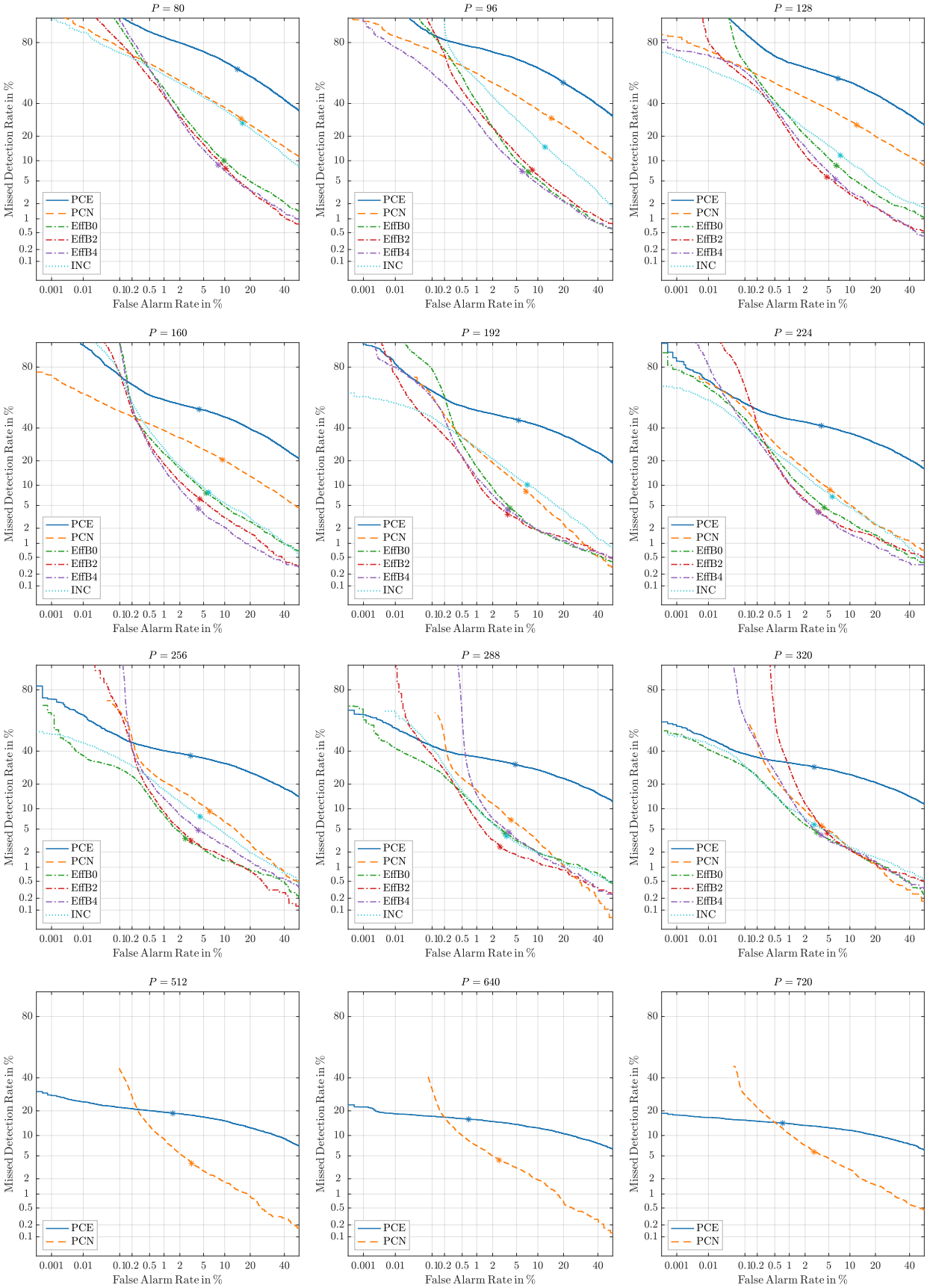

Fig. 4. DET curves as a function of crop size P. $*$ represents the minDCF point of each curve, considering an effective prior probability equal to 0.5.