

“Train one, Classify one, Teach one”

Cross-surgery transfer learning
for surgical step recognition

Daniel Neimark, Omri Bar, Maya Zohar,
Gregory D. Hager, Dotan Asselmann

- Time-series model architecture

C1D (K=5)	C1D (K=25)	C1D (K=39)	LSTM (L=1)	LSTM (L=2)	With SeSo	Transfer learning	RH	SG	APPY	AVG
			✓				93.1	94.0	88.9	92.0
✓						✓	89.2	85.3	80.0	84.8
	✓					✓	91.7	90.2	83.9	88.6
		✓				✓	92.1	90.7	84.9	89.2
✓	✓	✓				✓	91.7	90.2	84.9	88.9
			✓			✓	91.7	92.3	88.8	90.9
			✓		✓	✓	93.0	92.7	89.4	91.7
				✓		✓	93.3	91.7	89.8	91.6
				✓	✓	✓	92.0	91.8	89.3	91.0
✓	✓	✓		✓		✓	92.13	93.9	90.0	92.0
✓	✓	✓		✓	✓	✓	94.7	94.4	90.4	93.2

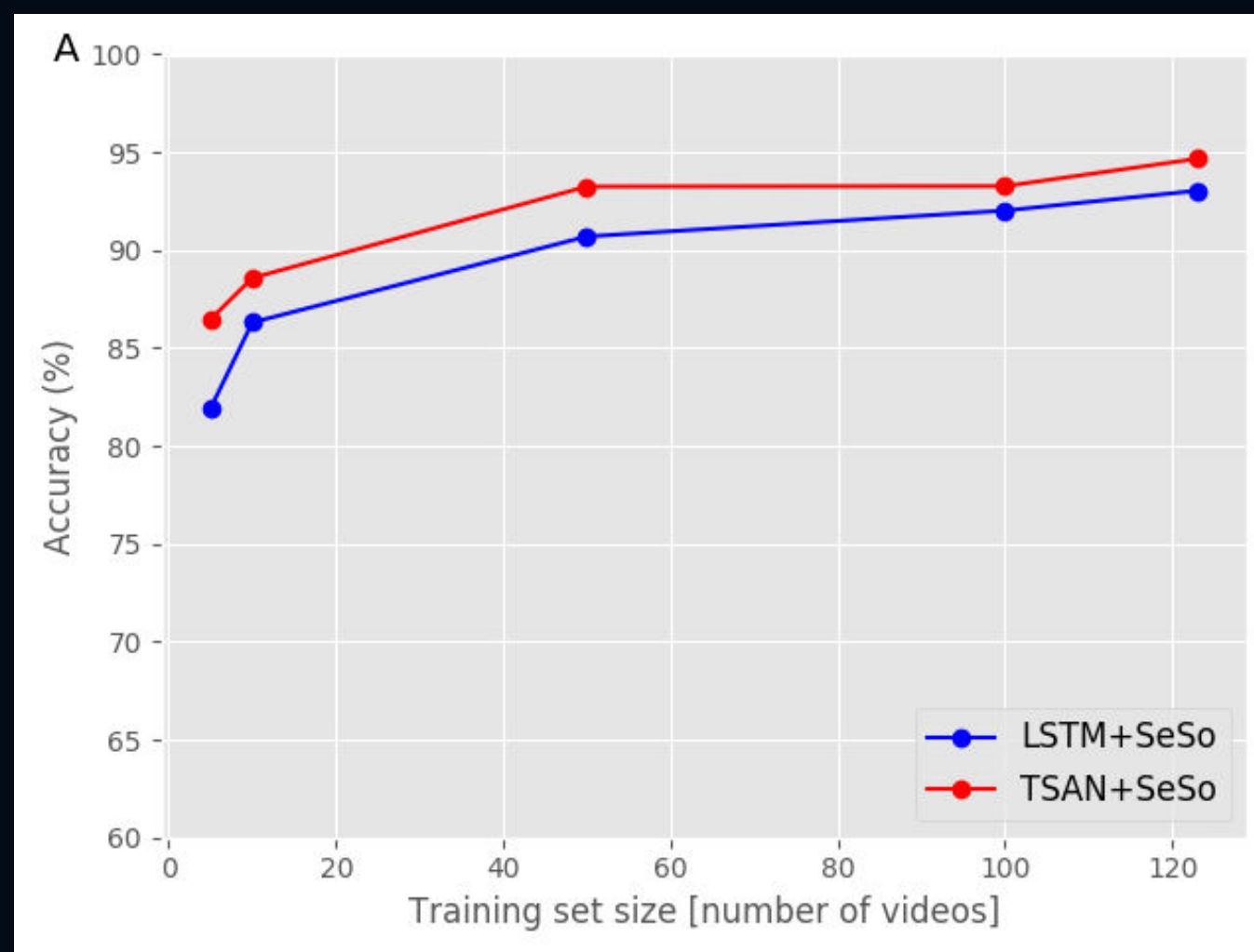
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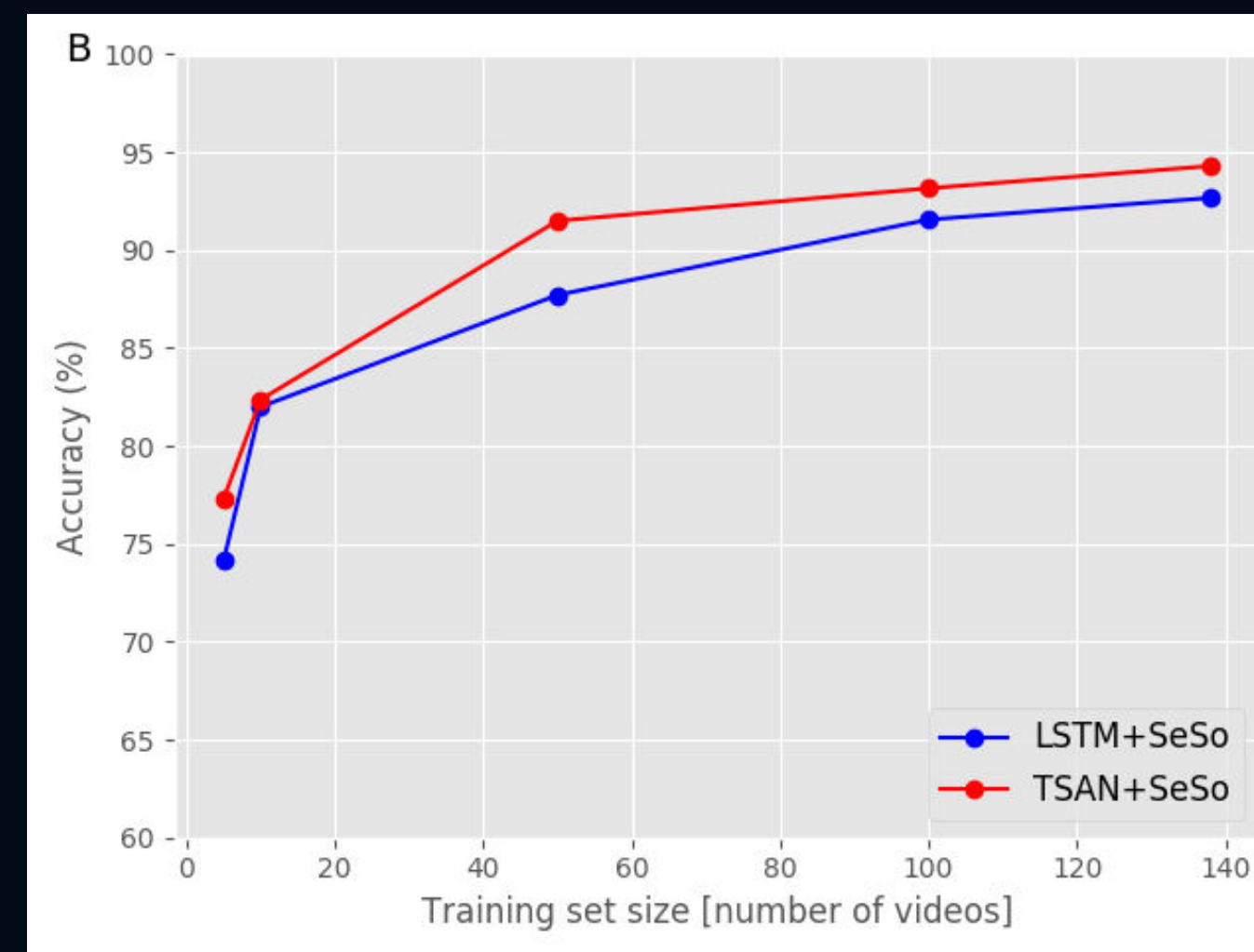
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- Impact of the dataset size on model generalization

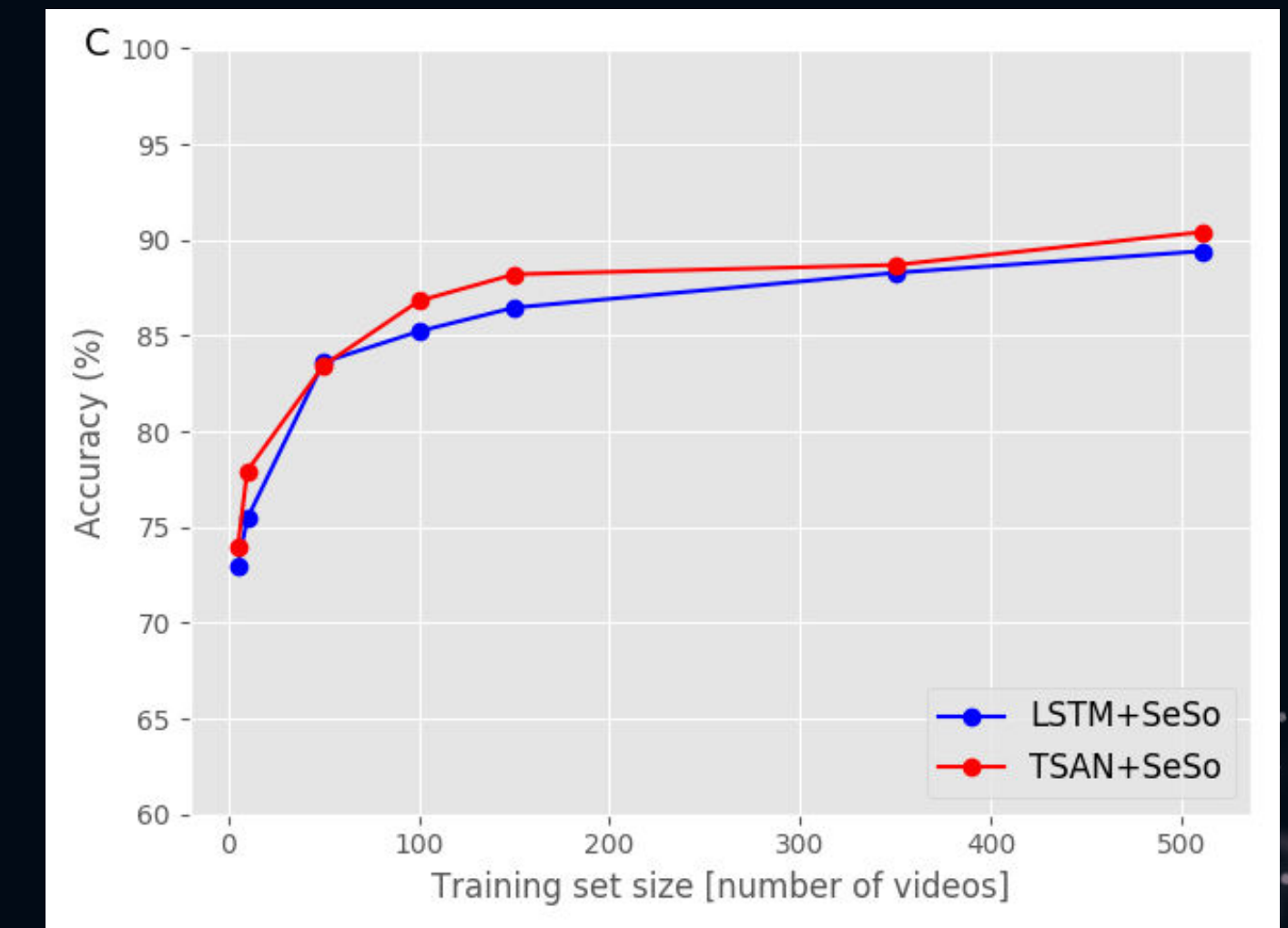
Right Hemicolectomy



Sleeve Gastrectomy



Appendectomy

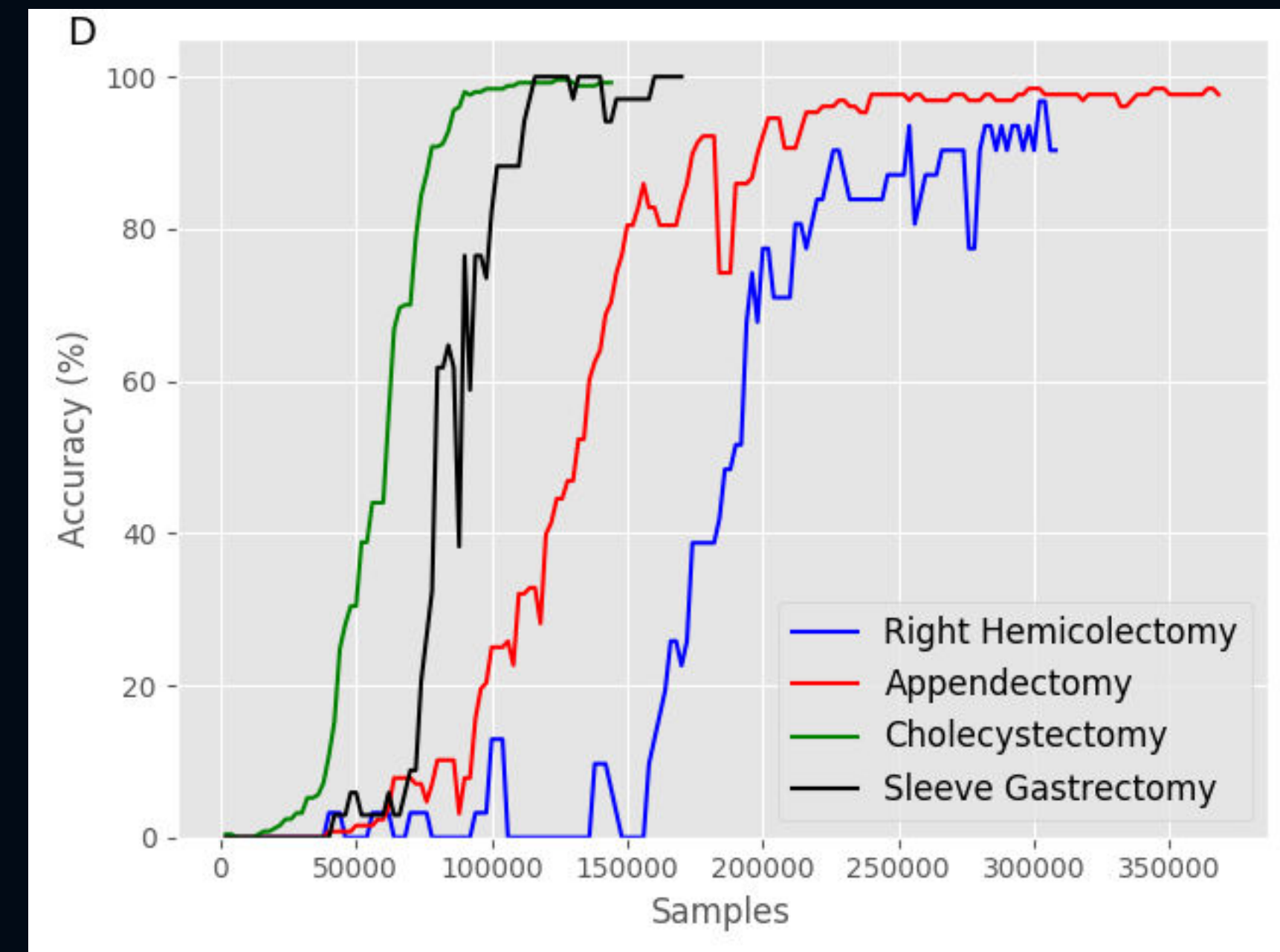


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- Training the SeSo task



Step training dataset	SeSo training dataset	Accuracy
Right Hemicolecotomy	Right Hemicolecotomy	94.5
Right Hemicolecotomy	Cholecystectomy	94.7
Sleeve Gastrectomy	Sleeve Gastrectomy	94.2
Sleeve Gastrectomy	Cholecystectomy	94.3
Appendectomy	Appendectomy	89.9
Appendectomy	Cholecystectomy	90.4