

Table 1: Latency Measurements - LeNet5 within the STM32L496ZG. "Sig." stands for "Sigmoid". Other LeNet5 topologies are with ReLU.

STM32L496ZG - Latency [ms/inference]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.1	212562.9300	228876.1738	7.6745	115444.4100	116589.7246	0.9921	59525.4368	51941.7209	12.7403	56818.7543	49887.4389	12.1990
0.2	89079.6650	95699.5061	7.4314	49006.1100	48872.7399	0.2722	24959.7350	21744.7267	12.8808	23826.6651	20882.7214	12.3557
0.4	41176.9025	44206.8283	7.3225	22645.5650	22585.1579	0.2668	11526.8273	10050.0646	12.8115	11002.7750	9651.7521	12.2789
0.8	19838.7138	21291.3960	7.3225	10916.1088	10881.9825	0.3126	5554.1939	4842.4412	12.8147	5301.6070	4650.5301	12.2807
1.0	15759.6940	16914.0194	7.3245	8670.3270	8640.1307	0.3483	4411.8066	3843.5458	12.8805	4211.2303	3691.1297	12.3503
2	7767.3480	8333.7694	7.2923	4272.4540	4305.8780	0.7823	2174.6184	1893.7869	12.9141	2075.6843	1818.7008	12.3807
4	3856.4628	4138.2648	7.3073	2121.0738	2113.7549	0.3451	1079.6522	940.2865	12.9084	1030.5465	902.9985	12.3767
8	1921.5760	2061.7970	7.2972	1056.8754	1053.2060	0.3472	537.9374	468.4973	12.9086	513.4679	449.9176	12.3767
16	959.1167	1029.0590	7.2924	527.5145	525.6492	0.3536	268.5001	233.8262	12.9139	256.2877	224.5533	12.3823
24	639.0351	685.6538	7.2952	351.4650	350.2326	0.3507	178.8949	155.7927	12.9138	170.7581	149.6142	12.3824
32	479.1386	514.0839	7.2934	263.5241	262.5854	0.3562	134.1318	116.8064	12.9167	128.0311	112.1741	12.3852
48	335.2523	360.4951	7.5295	175.8370	175.2102	0.3564	91.9372	78.0436	15.1121	87.8593	74.9560	14.6862
64	259.7158	281.3524	8.3309	131.9541	131.4744	0.3635	69.9324	58.6132	16.1860	66.8686	56.2979	15.8081
80	214.5681	233.5361	8.8401	105.6425	105.2548	0.3670	56.7331	46.9662	17.2156	54.2765	45.1141	16.8810
Mean			7.5395	Mean			0.4153	Mean			13.5798	13.0803

STM32L496ZG - Latency [ms/inference]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.1	40185.7736	36966.8753	8.0100	38360.9348	35597.2980	7.2043	25947.5958	25986.7154	0.1508	110383.4318	106785.4780	3.2595
0.2	16862.5147	15444.0970	8.4117	16097.2450	14886.3501	7.5224	10901.1619	10853.6912	0.4355	46031.7446	44521.9836	3.2798
0.4	7781.1112	7138.6723	8.2564	7427.3986	6880.9596	7.3571	5024.1728	5017.5317	0.1322	21283.9399	20584.9794	3.2840
0.8	3749.3409	3439.7075	8.2583	3578.9070	3315.5373	7.3589	2421.0041	2417.7238	0.1355	10256.0324	9918.6985	3.2891
1	2978.3851	2729.4929	8.3566	2843.0843	2630.8776	7.4640	1923.3993	1917.8303	0.2895	8145.6902	7877.8651	3.2879
2	1468.0449	1344.9581	8.3844	1401.3300	1296.3769	7.4895	948.0237	945.0995	0.3084	4015.0272	3931.8951	2.0705
4	728.8523	667.7367	8.3852	695.7338	643.6111	7.4918	470.6635	469.1660	0.3182	1993.3575	1927.7825	3.2897
8	363.1463	332.6927	8.3860	346.6453	320.6715	7.4929	234.5037	233.7499	0.3214	993.1801	960.4758	3.2929
16	181.2596	166.0472	8.3926	173.0231	160.0476	7.4993	117.0510	116.6657	0.3292	495.7194	479.3766	3.2968
24	120.7685	110.6322	8.3932	115.2808	106.6346	7.5001	77.9874	77.7297	0.3305	330.2864	319.4227	3.2892
32	90.5498	82.9477	8.3955	86.4353	79.9506	7.5023	58.4734	58.2794	0.3317	247.6425	239.4947	3.2901
48	62.8760	55.4756	11.7698	60.1226	53.4780	11.0518	41.4958	39.0334	5.9341	167.6022	162.5001	3.0442
64	48.1338	41.6903	13.3866	46.0603	40.1923	12.7399	32.1015	29.3608	8.5376	126.6746	122.8576	3.0132
80	39.2903	33.4284	14.9197	37.6265	32.2300	14.3425	26.4657	23.5652	10.9596	102.1278	99.1281	2.9372
Mean			9.4076	Mean			8.5726	Mean			2.0367	3.1374

Table 2: Energy consumption measurements - LeNet5 within the STM32L496ZG. "Sig." stands for "Sigmoid". Other LeNet5 topologies are with ReLU.

STM32L496ZG - Energy [J/inference]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.1	0.1040	0.1104	6.1416	0.0558	0.0551	1.1702	0.0285	0.0246	13.7033	0.0270	0.0236	12.5246
0.2	0.0482	0.0512	6.2430	0.0259	0.0252	2.5524	0.0131	0.0112	14.2391	0.0125	0.0108	13.6143
0.4	0.0264	0.0283	7.4945	0.0141	0.0136	3.4952	0.0071	0.0060	15.0595	0.0068	0.0058	14.3952
0.8	0.0164	0.0181	9.8300	0.0088	0.0084	4.4502	0.0045	0.0037	16.0745	0.0043	0.0036	15.3334
1.0	0.0147	0.0163	11.0473	0.0079	0.0075	4.7002	0.0040	0.0033	16.4461	0.0038	0.0032	15.7266
2	0.0109	0.0124	13.0214	0.0059	0.0056	4.6136	0.0030	0.0025	17.7619	0.0028	0.0024	16.8679
4	0.0091	0.0105	15.5916	0.0049	0.0046	6.3973	0.0025	0.0020	18.6605	0.0024	0.0020	17.7162
8	0.0082	0.0096	16.7940	0.0044	0.0041	7.0226	0.0023	0.0018	19.3846	0.0021	0.0017	18.4423
16	0.0078	0.0092	17.5178	0.0042	0.0039	7.3161	0.0022	0.0017	19.6834	0.0021	0.0017	18.6473
24	0.0076	0.0090	17.1828	0.0041	0.0038	7.5196	0.0021	0.0017	19.8436	0.0020	0.0016	18.8392
32	0.0076	0.0088	16.9940	0.0041	0.0038	7.5758	0.0021	0.0017	19.8676	0.0020	0.0016	18.9492
48	0.0078	0.0081	3.8929	0.0040	0.0036	10.1082	0.0021	0.0016	23.3716	0.0020	0.0015	22.5407
64	0.0080	0.0082	1.5032	0.0040	0.0037	8.1020	0.0021	0.0016	22.3599	0.0020	0.0016	21.5833
80	0.0083	0.0081	1.5013	0.0039	0.0036	7.8143	0.0021	0.0016	22.7488	0.0020	0.0016	21.9989
Mean			10.3397	Mean			Mean			Mean		

STM32L496ZG - Energy [J/inference]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.1	0.0193	0.0175	9.4115	0.0185	0.0168	9.2665	0.0126	0.0123	2.8530	0.0532	0.0511	3.9230
0.2	0.0089	0.0080	10.5762	0.0086	0.0077	10.2723	0.0059	0.0056	4.4047	0.0243	0.0232	4.1626
0.4	0.0049	0.0043	11.5962	0.0047	0.0041	11.0990	0.0032	0.0030	5.7411	0.0131	0.0125	4.2443
0.8	0.0031	0.0027	12.8004	0.0029	0.0026	12.3691	0.0020	0.0019	7.4469	0.0081	0.0077	4.4593
1	0.0027	0.0024	13.3166	0.0026	0.0023	12.7567	0.0018	0.0017	8.2641	0.0072	0.0069	4.4147
2	0.0021	0.0018	14.8278	0.0020	0.0017	14.2304	0.0014	0.0012	10.2277	0.0053	0.0051	3.5399
4	0.0017	0.0014	15.8798	0.0016	0.0014	15.1489	0.0012	0.0010	11.6971	0.0044	0.0042	4.9570
8	0.0016	0.0013	16.7374	0.0015	0.0012	15.9360	0.0010	0.0009	12.7704	0.0040	0.0038	5.1806
16	0.0015	0.0012	17.0393	0.0014	0.0012	16.2644	0.0010	0.0009	13.1938	0.0038	0.0036	5.2090
24	0.0015	0.0012	17.2125	0.0014	0.0012	16.4286	0.0010	0.0008	13.3818	0.0037	0.0035	5.2552
32	0.0014	0.0012	17.2403	0.0014	0.0011	16.4296	0.0010	0.0008	13.3606	0.0036	0.0035	5.2115
48	0.0014	0.0011	21.2120	0.0014	0.0011	20.4560	0.0010	0.0008	18.1257	0.0036	0.0035	4.2303
64	0.0015	0.0012	20.3036	0.0014	0.0011	19.5546	0.0010	0.0008	17.4454	0.0036	0.0034	5.1596
80	0.0015	0.0012	20.9079	0.0014	0.0011	20.1221	0.0010	0.0008	18.3408	0.0036	0.0034	5.1948
Mean			15.6473	Mean			Mean			Mean		

Table 3: Power measurements - LeNet5 within the STM32L496ZG. "Sig." stands for "Sigmoïde". Other LeNet5 topologies are with ReLU.

STM32L496ZG - Power [W]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.1	0.0005	0.0005	1.4237	0.0005	0.0005	2.1411	0.0005	0.0005	1.1037	0.0005	0.0005	0.3709
0.2	0.0005	0.0005	1.1062	0.0005	0.0005	2.2865	0.0005	0.0005	1.5591	0.0005	0.0005	1.4361
0.4	0.0006	0.0006	0.1268	0.0006	0.0006	3.2370	0.0006	0.0006	2.5782	0.0006	0.0006	2.4125
0.8	0.0008	0.0008	2.3365	0.0008	0.0008	4.1505	0.0008	0.0008	3.7389	0.0008	0.0008	3.4800
1.0	0.0009	0.0010	3.4687	0.0009	0.0009	4.3671	0.0009	0.0009	4.0928	0.0009	0.0009	3.8520
2	0.0014	0.0015	5.3397	0.0014	0.0013	5.3540	0.0014	0.0013	5.5668	0.0014	0.0013	5.1212
4	0.0024	0.0025	7.7202	0.0023	0.0022	6.0732	0.0023	0.0022	6.6047	0.0023	0.0022	6.0936
8	0.0043	0.0046	8.8509	0.0042	0.0039	6.6987	0.0042	0.0039	7.4359	0.0042	0.0039	6.9224
16	0.0082	0.0089	9.5305	0.0080	0.0074	6.9872	0.0081	0.0074	7.7733	0.0080	0.0074	7.1503
24	0.0120	0.0131	9.2154	0.0117	0.0109	7.1941	0.0118	0.0109	7.9574	0.0117	0.0109	7.3693
32	0.0158	0.0172	9.0412	0.0154	0.0143	7.2454	0.0156	0.0144	7.9819	0.0155	0.0144	7.4919
48	0.0232	0.0225	3.3819	0.0227	0.0205	9.7867	0.0228	0.0205	9.7299	0.0226	0.0205	9.2065
64	0.0310	0.0290	6.3026	0.0301	0.0278	7.7667	0.0300	0.0278	7.3662	0.0299	0.0278	6.8595
80	0.0385	0.0348	9.5015	0.0373	0.0345	7.4748	0.0370	0.0346	6.6839	0.0368	0.0346	6.1573
	Mean		5.5247	Mean		5.7688	Mean		5.7266	Mean		5.2803

STM32L496ZG - Power [W]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.1	0.0005	0.0005	1.5235	0.0005	0.0005	2.2223	0.0005	0.0005	2.9993	0.0005	0.0005	0.6859
0.2	0.0005	0.0005	2.3634	0.0005	0.0005	2.9736	0.0005	0.0005	3.9866	0.0005	0.0005	0.9128
0.4	0.0006	0.0006	3.6404	0.0006	0.0006	4.0391	0.0006	0.0006	5.6164	0.0006	0.0006	0.9929
0.8	0.0008	0.0008	4.9509	0.0008	0.0008	5.4081	0.0008	0.0008	7.3213	0.0008	0.0008	1.2099
1	0.0009	0.0009	5.4123	0.0009	0.0009	5.7196	0.0009	0.0009	7.9977	0.0009	0.0009	1.1651
2	0.0014	0.0013	7.0331	0.0014	0.0013	7.2866	0.0014	0.0013	9.9499	0.0013	0.0013	1.5004
4	0.0024	0.0022	8.1806	0.0024	0.0022	8.2772	0.0025	0.0022	11.4153	0.0022	0.0022	1.7240
8	0.0043	0.0039	9.1158	0.0043	0.0039	9.1270	0.0045	0.0039	12.4891	0.0040	0.0039	1.9520
16	0.0082	0.0074	9.4389	0.0082	0.0074	9.4757	0.0086	0.0075	12.9071	0.0076	0.0075	1.9774
24	0.0120	0.0109	9.6274	0.0121	0.0109	9.6524	0.0126	0.0109	13.0946	0.0112	0.0109	2.0328
32	0.0159	0.0144	9.6554	0.0159	0.0144	9.6514	0.0166	0.0144	13.0723	0.0147	0.0144	1.9867
48	0.0230	0.0206	10.7019	0.0230	0.0206	10.5727	0.0236	0.0206	12.9608	0.0216	0.0214	1.2234
64	0.0302	0.0278	7.9861	0.0302	0.0278	7.8097	0.0308	0.0278	9.7392	0.0286	0.0280	2.2131
80	0.0372	0.0346	7.0384	0.0371	0.0346	6.7474	0.0377	0.0346	8.2898	0.0354	0.0346	2.3259
	Mean		6.9049	Mean		7.0688	Mean		9.4171	Mean		1.5644

Table 4: Current measurements - LeNet5 within the STM32L496ZG. "Sig." stands for "Sigmoid". Other LeNet5 topologies are with ReLU.

STM32L496ZG - Current [mA]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.1	0.1480	0.1459	1.4237	0.1462	0.1430	2.1411	0.1446	0.1430	1.1037	0.1436	0.1430	0.3709
0.2	0.1637	0.1619	1.1062	0.1597	0.1560	2.2865	0.1585	0.1561	1.5591	0.1583	0.1561	1.4361
0.4	0.1938	0.1940	0.1268	0.1881	0.1821	3.2370	0.1869	0.1821	2.5782	0.1866	0.1821	2.4125
0.8	0.2508	0.2567	2.3365	0.2442	0.2341	4.1505	0.2433	0.2342	3.7389	0.2427	0.2343	3.4800
1.0	0.2827	0.2925	3.4687	0.2750	0.2630	4.3671	0.2745	0.2632	4.0928	0.2738	0.2633	3.8520
2	0.4257	0.4485	5.3397	0.4154	0.3932	5.3540	0.4168	0.3936	5.5668	0.4149	0.3936	5.1212
4	0.7137	0.7687	7.7202	0.6970	0.6547	6.0732	0.7019	0.6556	43.9261	0.6982	0.6556	6.0936
8	1.2888	1.4028	8.8509	1.2592	1.1749	6.6987	1.2712	1.1767	7.4359	1.2644	1.1768	6.9224
16	2.4681	2.7033	9.5305	2.4150	2.2462	6.9872	2.4395	2.2499	7.7733	2.4234	2.2501	7.1503
24	3.6186	3.9521	9.2154	3.5403	3.2856	7.1941	3.5754	3.2909	7.9574	3.5532	3.2913	7.3693
32	4.7762	5.2080	9.0412	4.6743	4.3357	7.2454	4.7194	4.3427	7.9819	4.6949	4.3432	7.4919
48	7.0319	6.7941	3.3819	6.8805	6.2071	9.7867	6.8840	6.2142	9.7299	6.8449	6.2147	9.2065
64	9.3711	8.7804	6.3026	9.1219	8.4134	7.7667	9.0872	8.4178	7.3662	9.0381	8.4181	6.8595
80	11.6429	10.5367	9.5015	11.2981	10.4536	7.4748	11.2046	10.4557	6.6839	11.1419	10.4559	6.1573
		Mean	5.5247		Mean	5.7688		Mean	8.3924		Mean	5.2803

STM32L496ZG - Current [mA]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.1	0.1453	0.1431	1.5235	0.1463	0.1431	2.2223	0.1475	0.1431	2.9993	0.1459	0.1449	0.6859
0.2	0.1599	0.1561	2.3634	0.1609	0.1561	2.9736	0.1626	0.1561	3.9866	0.1594	0.1580	0.9128
0.4	0.1889	0.1821	3.6404	0.1897	0.1821	4.0391	0.1929	0.1821	5.6164	0.1861	0.1842	0.9929
0.8	0.2466	0.2344	4.9509	0.2478	0.2344	5.4081	0.2531	0.2346	7.3213	0.2392	0.2363	1.2099
1	0.2785	0.2634	5.4123	0.2794	0.2634	5.7196	0.2866	0.2637	7.9977	0.2686	0.2655	1.1651
2	0.4237	0.3939	7.0331	0.4249	0.3940	7.2866	0.4380	0.3944	9.9499	0.4023	0.3963	1.5004
4	0.7147	0.6562	8.1806	0.7156	0.6563	8.2772	0.7419	0.6572	11.4153	0.6703	0.6587	1.7240
8	1.2962	1.1780	9.1158	1.2965	1.1782	9.1270	1.3484	1.1800	12.4891	1.2063	1.1827	1.9520
16	2.4873	2.2525	9.4389	2.4887	2.2529	9.4757	2.5909	2.2565	12.9071	2.3069	2.2613	1.9774
24	3.6458	3.2948	9.6274	3.6474	3.2953	9.6524	3.7979	3.3006	13.0946	3.3797	3.3110	2.0328
32	4.8124	4.3478	9.6554	4.8130	4.3485	9.6514	5.0103	4.3553	13.0723	4.4583	4.3698	1.9867
48	6.9640	6.2187	10.7019	6.9547	6.2194	10.5727	7.1518	6.2248	12.9608	6.5485	6.4684	1.2234
64	9.1512	8.4204	7.9861	9.1341	8.4207	7.8097	9.3323	8.4234	9.7392	8.6663	8.4745	2.2131
80	11.2481	10.4565	7.0384	11.2131	10.4565	6.7474	11.4016	10.4564	8.2898	10.7261	10.4766	2.3259
		Mean	6.9049		Mean	7.0688		Mean	9.4171		Mean	1.5644

Table 5: Latency measurements - LeNet5 within STM32F446ZE. "Sig." stands for "Sigmoïde". Other LeNet5 topologies are with ReLU.

STM32F446ZE - Latency [ms/inference]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
16	960.6476	1025.7559	6.7775	646.1610	513.5568	20.5219	270.9652	222.1771	18.0053	258.8639	212.9066	17.7534
24	639.7541	683.4384	6.8283	430.5216	342.1849	20.5185	180.5398	149.1638	17.3790	172.4747	141.8593	17.7506
32	482.3763	513.9580	6.5471	324.6242	258.0765	20.4999	137.1694	114.2154	16.7340	131.1177	107.8929	17.7129
48	321.4602	342.5451	6.5591	216.3540	172.0225	20.4902	91.4190	74.9974	17.9629	87.3890	71.9106	17.7120
64	241.9785	257.6258	6.4664	163.1523	129.7501	20.4730	69.4530	56.9955	17.9366	66.4280	54.6810	17.6839
80	193.5658	206.0977	6.4742	130.5096	103.7985	20.4668	55.5580	45.5965	17.9299	53.1377	43.7448	17.6766
90	171.9055	183.1835	6.5606	116.0036	92.2537	20.4734	49.3826	40.5265	17.9336	47.2319	38.8808	17.6811
100	155.4141	165.4310	6.4453	104.9853	83.5343	20.4324	45.0209	36.9756	17.8701	43.0866	35.4943	17.6210
116	133.9705	142.5533	6.4065	90.5005	72.0066	20.4352	38.8095	31.8741	17.8703	37.1426	30.5972	17.6223
124	125.6554	133.7888	6.4728	85.1342	67.7457	20.4248	36.7736	30.2034	17.8666	35.2136	29.0090	17.6198
132	118.0379	125.6881	6.4811	79.9734	63.6409	20.4224	34.5440	28.3738	17.8617	33.0788	27.2517	17.6157
148	105.2726	112.0941	6.4799	71.3259	56.7631	20.4172	30.8088	25.3066	17.8591	29.4950	24.3058	17.5935
164	95.3482	101.4439	6.3930	64.7252	51.5275	20.3904	28.1580	23.1408	17.8179	26.9749	22.2378	17.5612
180	86.8688	92.4161	6.3858	58.9709	46.9447	20.3934	25.6545	21.0813	17.8261	24.5807	20.2587	17.5828
		Mean	6.5198		Mean	20.4543		Mean	17.7752		Mean	17.6562

STM32F446ZE - Latency [ms/inference]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
16	183.0761	154.6078	15.5500	174.7570	148.4281	15.0660	118.2180	105.0042	11.1775	503.4884	486.1511	3.4435
24	121.9797	102.8958	15.6451	116.4365	98.8970	15.0635	78.7657	69.9639	11.1746	335.4657	323.9297	3.4388
32	93.2547	78.6805	15.6284	89.0955	75.6825	15.0547	60.8505	53.9886	11.2766	253.3313	244.7168	3.4005
48	62.1535	52.4393	15.6294	59.3839	50.4410	15.0596	40.5591	35.9826	11.2835	169.0348	163.2442	3.4257
64	47.4992	40.0814	15.6167	45.4220	38.5829	15.0568	31.3054	27.7428	11.3802	127.5785	123.1945	3.4363
80	37.9956	32.0646	15.6096	36.3350	30.8658	15.0520	25.0421	22.1926	11.3786	102.0577	98.6344	3.3543
90	33.7747	28.4995	15.6186	32.2955	27.4341	15.0529	22.2585	19.7251	11.3817	90.7304	87.6316	3.4154
100	30.9755	26.1504	15.5771	29.6451	25.1914	15.0233	20.6115	18.2528	11.4437	82.1677	79.5279	3.2128
116	26.7020	22.5426	15.5770	25.5552	21.7160	15.0233	17.7680	15.7344	11.4453	70.8315	68.5710	3.1914
124	25.4447	21.4748	15.6022	24.3730	20.7016	15.0633	17.0870	15.1071	11.5877	66.7229	64.4892	3.3476
132	23.9022	20.1737	15.5990	22.8957	19.4473	15.0614	16.0512	14.1909	11.5895	62.6780	60.5767	3.3526
148	21.3106	17.9928	15.5687	20.4127	17.3449	15.0288	14.3078	12.6570	11.5376	55.8963	54.0470	3.3085
164	19.5907	16.5415	15.5644	18.7791	15.9569	15.0285	13.2710	11.7275	11.6303	50.8015	49.1003	3.3487
180	17.8529	15.0697	15.5894	17.1137	14.5371	15.0559	12.0950	10.6851	11.6571	46.2854	44.7395	3.3399
		Mean	15.5983		Mean	15.0493		Mean	11.4246		Mean	3.3583

Table 6: Energy consumption measurements - LeNet5 within the STM32F446ZE. "Sig." stands for "Sigmoid". Other LeNet5 topologies are with ReLU.

STM32F446ZE - Energy [J/inference]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
16	0.0236	0.0223	5.2060	0.0142	0.0105	26.4635	0.0065	0.0045	30.4590	0.0050	0.0044	13.4959
24	0.0213	0.0202	5.1333	0.0129	0.0097	24.7120	0.0056	0.0042	24.8381	0.0049	0.0040	17.6961
32	0.0183	0.0175	4.3790	0.0113	0.0085	24.6696	0.0050	0.0038	24.1313	0.0044	0.0036	19.2222
48	0.0159	0.0165	3.3139	0.0097	0.0086	12.1361	0.0043	0.0037	12.8841	0.0037	0.0036	3.7204
64	0.0142	0.0134	5.4536	0.0087	0.0067	23.0905	0.0039	0.0029	23.7051	0.0034	0.0028	17.8439
80	0.0135	0.0128	5.6318	0.0083	0.0064	23.3151	0.0037	0.0028	23.7519	0.0033	0.0027	18.8064
90	0.0133	0.0125	5.7796	0.0081	0.0062	24.0113	0.0036	0.0027	24.6573	0.0033	0.0026	20.1823
100	0.0127	0.0134	6.0212	0.0079	0.0071	10.0153	0.0035	0.0031	10.1534	0.0031	0.0030	3.7325
116	0.0123	0.0131	6.0332	0.0077	0.0069	9.8935	0.0034	0.0031	9.9954	0.0031	0.0029	4.3998
124	0.0132	0.0143	8.5178	0.0084	0.0076	9.7128	0.0037	0.0034	8.3588	0.0033	0.0032	2.7144
132	0.0131	0.0142	8.7092	0.0083	0.0075	9.7379	0.0037	0.0034	8.3730	0.0033	0.0032	2.8915
148	0.0135	0.0133	1.8336	0.0086	0.0067	22.3957	0.0038	0.0030	20.8510	0.0035	0.0029	17.3297
164	0.0132	0.0132	0.4416	0.0085	0.0067	21.8469	0.0037	0.0030	19.8345	0.0034	0.0029	16.2786
180	0.0134	0.0145	8.1536	0.0086	0.0076	11.4296	0.0038	0.0034	9.1609	0.0035	0.0033	5.5074
	Mean		5.3291	Mean		18.1021	Mean		17.9396	Mean		11.7015

STM32F446ZE - Energy [J/inference]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
16	0.0044	0.0032	27.4077	0.0044	0.0030	30.7864	0.0032	0.0023	28.9890	0.0123	0.0088	28.9132
24	0.0040	0.0029	26.4379	0.0039	0.0028	27.8650	0.0029	0.0021	27.4678	0.0106	0.0081	23.2745
32	0.0036	0.0026	27.6945	0.0035	0.0025	28.8453	0.0026	0.0018	30.0248	0.0090	0.0071	20.5964
48	0.0029	0.0026	10.4469	0.0028	0.0025	11.4424	0.0021	0.0017	16.0715	0.0075	0.0066	12.6705
64	0.0027	0.0021	22.9066	0.0026	0.0020	23.4150	0.0019	0.0014	24.4012	0.0068	0.0057	16.1256
80	0.0026	0.0020	23.3984	0.0025	0.0019	23.5049	0.0018	0.0014	25.4192	0.0064	0.0055	15.0204
90	0.0025	0.0019	24.5580	0.0024	0.0018	24.4726	0.0018	0.0013	25.6385	0.0063	0.0053	14.9660
100	0.0024	0.0022	7.9455	0.0023	0.0021	8.1542	0.0017	0.0015	13.2173	0.0059	0.0055	7.6338
116	0.0024	0.0022	8.4402	0.0023	0.0021	8.4524	0.0017	0.0014	13.8438	0.0058	0.0054	6.5609
124	0.0025	0.0024	5.6595	0.0025	0.0023	5.4840	0.0018	0.0016	9.6350	0.0062	0.0060	3.2518
132	0.0025	0.0024	5.7545	0.0024	0.0023	5.6674	0.0018	0.0016	9.5867	0.0062	0.0060	2.8514
148	0.0026	0.0021	19.7002	0.0025	0.0020	19.4084	0.0019	0.0015	19.1585	0.0064	0.0060	6.7474
164	0.0026	0.0021	17.9806	0.0025	0.0021	17.4199	0.0018	0.0015	16.6814	0.0063	0.0060	5.7728
180	0.0026	0.0024	6.9937	0.0025	0.0024	6.6578	0.0018	0.0017	8.8824	0.0063	0.0063	0.0236
	Mean		16.8089	Mean		17.2554	Mean		19.2155	Mean		11.7434

Table 7: Power measurements - LeNet5 within the STM32F446ZE. "Sig." stands for "Sigmoïde". Other LeNet5 topologies are with ReLU.

STM32F446ZE - Power [W]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
16	0.0245	0.0218	11.2229	0.0220	0.0204	7.4759	0.0241	0.0204	15.1884	0.0194	0.0205	5.1765
24	0.0332	0.0295	11.1970	0.0299	0.0283	5.2760	0.0312	0.0284	9.0282	0.0284	0.0284	0.0664
32	0.0379	0.0341	10.2548	0.0349	0.0330	5.2449	0.0363	0.0331	8.8839	0.0337	0.0331	1.8342
48	0.0495	0.0480	3.0455	0.0450	0.0497	10.5070	0.0469	0.0498	6.1909	0.0425	0.0498	17.0032
64	0.0586	0.0521	11.1960	0.0533	0.0515	3.2913	0.0555	0.0516	7.0293	0.0517	0.0516	0.1944
80	0.0699	0.0620	11.3699	0.0638	0.0615	3.5812	0.0663	0.0616	7.0940	0.0625	0.0616	1.3724
90	0.0771	0.0682	11.5804	0.0701	0.0669	4.4487	0.0730	0.0670	8.1930	0.0691	0.0670	3.0385
100	0.0814	0.0811	0.3984	0.0751	0.0849	13.0921	0.0775	0.0847	9.3958	0.0727	0.0850	16.8594
116	0.0920	0.0917	0.3508	0.0849	0.0962	13.2492	0.0878	0.0962	9.5884	0.0829	0.0962	16.0511
124	0.1050	0.1070	1.9207	0.0986	0.1119	13.4616	0.1003	0.1119	11.5761	0.0948	0.1119	18.0935
132	0.1107	0.1130	2.0924	0.1042	0.1182	13.4266	0.1060	0.1182	11.5521	0.1003	0.1182	17.8725
148	0.1283	0.1183	7.8076	0.1209	0.1179	2.4861	0.1224	0.1180	3.6424	0.1176	0.1180	0.3201
164	0.1388	0.1299	6.4239	0.1317	0.1292	1.8296	0.1326	0.1294	2.4539	0.1274	0.1294	1.5558
180	0.1541	0.1566	1.6617	0.1460	0.1625	11.2602	0.1470	0.1625	10.5449	0.1417	0.1625	14.6516
	Mean		6.4659	Mean		7.7593	Mean		8.5972	Mean		8.1493

STM32F446ZE - Power [W]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
16	0.0238	0.0205	14.0411	0.0251	0.0205	18.5089	0.0272	0.0218	20.0529	0.0245	0.0180	26.3780
24	0.0326	0.0284	12.7945	0.0335	0.0284	15.0718	0.0362	0.0296	18.3429	0.0316	0.0251	20.5421
32	0.0386	0.0331	14.3012	0.0395	0.0331	16.2346	0.0432	0.0341	21.1311	0.0355	0.0292	17.8013
48	0.0469	0.0498	6.1426	0.0478	0.0498	4.2585	0.0510	0.0482	5.3969	0.0446	0.0403	9.5727
64	0.0566	0.0517	8.6390	0.0573	0.0517	9.8398	0.0612	0.0522	14.6931	0.0532	0.0462	13.1408
80	0.0679	0.0617	9.2295	0.0685	0.0617	9.9506	0.0738	0.0621	15.8434	0.0632	0.0555	12.0710
90	0.0751	0.0671	10.5940	0.0755	0.0671	11.0889	0.0814	0.0683	16.0878	0.0693	0.0610	11.9591
100	0.0779	0.0850	9.0398	0.0786	0.0850	8.0836	0.0831	0.0814	2.0028	0.0721	0.0688	4.5678
116	0.0888	0.0963	8.4536	0.0894	0.0963	7.7326	0.0947	0.0922	2.7085	0.0813	0.0785	3.4806
124	0.1001	0.1119	11.7807	0.1006	0.1119	11.2782	0.1051	0.1075	2.2085	0.0931	0.0932	0.0991
132	0.1059	0.1182	11.6640	0.1065	0.1182	11.0597	0.1110	0.1135	2.2653	0.0982	0.0987	0.5186
148	0.1241	0.1180	4.8933	0.1244	0.1180	5.1542	0.1296	0.1184	8.6149	0.1146	0.1105	3.5565
164	0.1333	0.1295	2.8616	0.1332	0.1295	2.8144	0.1380	0.1301	5.7159	0.1249	0.1218	2.5080
180	0.1475	0.1625	10.1832	0.1479	0.1625	9.8866	0.1524	0.1572	3.1408	0.1362	0.1408	3.4309
	Mean		9.6156	Mean		10.0688	Mean		9.8718	Mean		9.2590

Table 8: Current measurements - LeNet5 within the STM32F446ZE. "Sig." stands for "Sigmoid". Other LeNet5 topologies are with ReLU.

STM32F446ZE - Current [mA]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
16	7.4204	6.5876	11.2229	6.6717	6.1729	7.4759	7.2954	6.1874	15.1884	5.8839	6.1884	5.1765
24	10.0597	8.9333	11.1970	9.0520	8.5744	5.2760	9.4450	8.5923	9.0282	8.5879	8.5936	0.0664
32	11.4805	10.3032	10.2548	10.5508	9.9974	5.2449	10.9862	10.0102	8.8839	10.1982	10.0112	1.8342
48	14.9906	14.5341	3.0455	13.6213	15.0525	10.5070	14.1804	15.0583	6.1909	12.8704	15.0587	17.0032
64	17.7410	15.7547	11.1960	16.1282	15.5974	3.2913	16.8001	15.6191	7.0293	15.6512	15.6208	0.1944
80	21.1535	18.7484	11.3699	19.3035	18.6122	3.5812	20.0618	18.6386	7.0940	18.9000	18.6406	1.3724
90	23.3288	20.6272	11.5804	21.1966	20.2536	4.4487	22.0942	20.2840	8.1930	20.9221	20.2864	3.0385
100	24.6287	24.5305	0.3984	22.7204	25.6950	13.0921	23.4401	25.6425	9.3958	21.9953	25.7036	16.8594
116	27.8514	27.7537	0.3508	25.7012	29.1064	13.2492	26.5677	29.1151	9.5884	25.0888	29.1158	2.4504
124	31.7612	32.3712	1.9207	29.8328	33.8488	13.4616	30.3455	33.8583	11.5761	28.6714	33.8590	18.0935
132	33.4845	34.1852	2.0924	31.5197	35.7517	13.4266	32.0585	35.7620	11.5521	30.3402	35.7627	17.8725
148	38.8156	35.7850	7.8076	36.5791	35.6697	2.4861	37.0413	35.6921	3.6424	35.5799	35.6938	0.3201
164	42.0032	39.3050	6.4239	39.8339	39.1051	1.8296	40.1283	39.1436	2.4539	38.5468	39.1465	1.5558
180	46.6150	47.3896	1.6617	44.1784	49.1529	11.2602	44.4723	49.1619	10.5449	42.8799	49.1626	14.6516
	Mean		6.4659	Mean		7.7593	Mean		8.5972	Mean		7.1778

STM32F446ZE - Current [mA]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
16	7.2109	6.1984	14.0411	7.6081	6.1999	18.5089	8.2378	6.5859	20.0529	7.4069	5.4531	26.3780
24	9.8686	8.6060	12.7945	10.1354	8.6079	15.0718	10.9513	8.9425	18.3429	9.5624	7.5981	20.5421
32	11.6924	10.0202	14.3012	11.9639	10.0216	16.2346	13.0682	10.3067	21.1311	10.7485	8.8351	17.8013
48	14.1934	15.0652	6.1426	14.4508	15.0662	4.2585	15.4215	14.5893	5.3969	13.4808	12.1903	9.5727
64	17.1144	15.6359	8.6390	17.3449	15.6382	9.8398	18.5053	15.7863	14.6931	16.1079	13.9911	13.1408
80	20.5560	18.6588	9.2295	20.7237	18.6616	9.9506	22.3279	18.7904	15.8434	19.1109	16.8040	12.0710
90	22.7133	20.3071	10.5940	22.8433	20.3102	11.0889	24.6202	20.6594	16.0878	20.9642	18.4570	11.9591
100	23.5817	25.7134	9.0398	23.7916	25.7148	8.0836	25.1462	24.6426	2.0028	21.8243	20.8274	4.5678
116	26.8563	29.1266	8.4536	27.0375	29.1282	7.7326	28.6585	27.8822	2.7085	24.5964	23.7403	3.4806
124	30.3011	33.8708	11.7807	30.4395	33.8725	11.2782	31.8089	32.5115	2.2085	28.1629	28.1908	0.0991
132	32.0379	35.7748	11.6640	32.2138	35.7766	11.0597	33.5726	34.3331	2.2653	29.7137	29.8678	0.5186
148	37.5461	35.7089	4.8933	37.6518	35.7112	5.1542	39.2041	35.8267	8.6149	34.6687	33.4357	3.5565
164	40.3263	39.1723	2.8616	40.3108	39.1763	2.8144	41.7515	39.3650	5.7159	37.7975	36.8496	2.5080
180	44.6300	49.1747	10.1832	44.7521	49.1765	9.8866	46.1040	47.5521	3.1408	41.1993	42.6128	3.4309
	Mean		9.6156	Mean		10.0688	Mean		9.8718	Mean		9.2590

Table 9: Latency measurements - LeNet5 within the STM32F746ZG. "Sig." stands for "Sigmoïde". Other LeNet5 topologies are with ReLU.

STM32F746ZG - Latency [ms/inference]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.2	88217.4272	87354.6348	0.9780	85125.8016	69856.1001	17.9378	35239.3799	31975.6975	9.2615	33561.4060	30798.2982	8.2330
0.4	35363.7233	34906.0296	1.2942	32802.3426	27906.4087	14.9256	13667.7864	12377.2310	9.4423	13155.0427	11894.5517	9.5818
0.8	16009.5262	15905.4303	0.6502	14801.4147	12722.9402	14.0424	6184.3748	5610.4526	9.2802	5929.0448	5389.3455	9.1026
1	12776.2386	12836.2477	0.4697	10903.8061	10428.1315	4.3625	4462.8822	4421.1826	0.9344	4257.9473	4234.0806	0.5605
4	3024.3189	3040.5997	0.5383	2575.4620	2476.1674	3.8554	1055.1263	1042.5760	1.1895	1006.0464	997.9195	0.8078
16	765.3008	759.6993	0.7319	634.9816	621.1179	2.1833	260.1859	257.3783	1.0791	247.9915	246.0866	0.7681
48	275.3221	275.0074	0.1143	239.4481	223.1191	6.8194	103.0308	92.1147	10.5950	98.7380	88.0801	10.7942
80	179.0045	178.8173	0.1046	160.9733	143.2511	11.0094	67.3869	62.4874	7.2708	64.6329	59.9770	7.2036
100	151.9776	157.7889	3.8238	137.9922	127.5462	7.5700	59.4101	51.1349	13.9291	56.9131	48.7791	14.2920
116	138.7316	154.3903	11.2870	129.7704	127.5838	1.6850	51.2771	53.5921	4.5146	48.6063	51.2922	5.5258
148	96.0996	100.1649	4.2303	89.3575	80.7646	1.5927	43.6642	45.7188	4.7055	41.3856	43.7564	5.7287
180	114.0281	131.6911	15.4901	110.6098	108.8480	10.4965	39.0206	35.8954	8.0089	37.3654	34.4342	7.8446
200	95.3813	99.3556	4.1668	90.1760	80.0204	9.6163	38.8357	32.3495	16.7015	37.2052	30.8566	17.0637
216	100.9471	103.2806	2.3116	92.6121	82.8911	11.2620	39.2226	32.0367	18.3209	37.5354	30.5572	18.5910
		Mean	3.2993		Mean	8.3827		Mean	8.2309		Mean	8.2927

STM32F746ZG - Latency [ms/inference]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.2	23064.4163	23453.1267	1.6853	22637.3991	22674.1860	0.1625	14933.8895	17231.4249	15.3847	69593.9849	66011.7752	5.1473
0.4	9280.1261	8883.3184	4.2759	8825.7190	8563.9822	2.9656	5792.3592	6332.7139	9.3288	28142.6063	26366.5038	6.3111
0.8	4180.7275	4010.0179	4.0833	3973.7979	3863.7437	2.7695	2615.4955	2841.6231	8.6457	12816.4410	12000.4975	6.3664
1	2973.9134	3066.9528	3.1285	2835.3210	2943.1829	3.8042	1878.9705	2078.2441	10.6055	10266.2443	10464.5410	1.9315
4	701.7317	719.3597	2.5121	669.4968	689.8195	3.0355	444.4980	483.3793	8.7472	2440.7321	2478.8693	1.5625
16	173.0485	175.5334	1.4359	165.0625	168.0495	1.8096	109.6466	115.8763	5.6816	568.4775	611.0863	7.4952
48	71.3594	62.9079	11.8436	68.4678	60.2384	12.0194	48.0009	41.5882	13.3596	219.1308	187.4932	14.4378
80	45.3004	44.3176	2.1695	43.3682	42.6570	1.6399	28.4984	31.0521	8.9607	141.7607	125.9945	11.1217
100	41.1509	34.0807	17.1812	39.4794	32.5219	17.6231	27.7212	21.6325	21.9640	122.5846	102.1277	16.6880
116	33.4242	36.9178	10.4524	31.6062	35.3930	11.9811	20.6765	24.7675	19.7860	106.2913	117.2023	10.2652
148	28.4470	31.4913	10.7016	26.9036	30.1902	12.2163	17.5946	21.1240	20.0597	90.0235	100.0879	11.1797
180	26.2390	25.3186	3.5077	25.0657	24.3519	2.8479	16.4884	17.5972	6.7244	80.8967	66.4465	17.8625
200	27.0146	21.5413	20.2605	25.9060	20.5534	20.6618	18.2774	13.6526	25.3034	76.2662	60.6779	20.4394
216	27.2221	21.3253	21.6617	26.1357	20.3463	22.1512	18.4590	13.5075	26.8245	75.4303	59.2440	21.4586
		Mean	8.2071		Mean	8.2634		Mean	14.3840		Mean	10.8762

Table 10: Energy consumption measurements - LeNet5 within the STM32F746ZG. "Sig." stands for "Sigmoid". Other LeNet5 topologies are with ReLU.

STM32F746ZG - Energy [J/inference]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.2	2.6981	2.6914	0.2481	2.7444	2.1544	21.4959	1.0853	0.9919	8.6126	1.0077	0.9558	5.1518
0.4	1.0966	1.0961	0.0394	1.0752	0.8833	17.8479	0.4292	0.3968	7.5309	0.3996	0.3817	4.4803
0.8	0.4993	0.5071	1.5650	0.5021	0.4131	17.7347	0.2007	0.1869	6.8644	0.1879	0.1799	4.2525
1	0.3263	0.3394	4.0121	0.3065	0.2851	6.9880	0.1189	0.1262	6.0807	0.1097	0.1212	10.4933
4	0.0938	0.0966	2.9132	0.0883	0.0862	2.3068	0.0345	0.0398	15.2325	0.0319	0.0383	19.8785
16	0.0391	0.0397	1.5822	0.0365	0.0345	5.5404	0.0146	0.0148	1.9151	0.0135	0.0142	5.2730
48	0.0306	0.0317	3.3995	0.0298	0.0249	16.3820	0.0127	0.0102	19.9119	0.0120	0.0097	19.1873
80	0.0258	0.0250	3.2248	0.0262	0.0228	13.2236	0.0110	0.0103	6.5708	0.0105	0.0099	5.7719
100	0.0261	0.0271	4.1428	0.0261	0.0249	4.6348	0.0112	0.0103	7.9211	0.0106	0.0098	7.4724
116	0.0266	0.0280	5.2140	0.0275	0.0283	2.6526	0.0109	0.0123	13.1324	0.0103	0.0118	14.6556
148	0.0239	0.0235	1.5209	0.0243	0.0228	6.1388	0.0119	0.0133	11.9698	0.0112	0.0127	13.3125
180	0.0333	0.0372	11.6661	0.0353	0.0383	8.4017	0.0125	0.0130	4.3134	0.0119	0.0125	4.6789
200	0.0305	0.0314	2.9803	0.0307	0.0303	1.0711	0.0131	0.0126	4.0168	0.0125	0.0120	4.1038
216	0.0336	0.0340	1.2466	0.0325	0.0336	3.3893	0.0137	0.0134	2.2375	0.0131	0.0128	2.1917
	Mean		3.1254	Mean		9.1291	Mean		8.3079	Mean		8.6359

STM32F746ZG - Energy [J/inference]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.2	0.6789	0.7307	7.6334	0.6892	0.7069	2.5663	0.4521	0.5405	19.5622	2.2063	2.2671	2.7563
0.4	0.2818	0.2876	2.0591	0.2746	0.2776	1.0977	0.1786	0.2080	16.4727	0.8964	0.9203	2.6678
0.8	0.1310	0.1361	3.8665	0.1281	0.1314	2.6310	0.0833	0.0990	18.8745	0.4060	0.4262	4.9880
1	0.0757	0.0902	19.0940	0.0751	0.0869	15.6712	0.0488	0.0638	30.7861	0.2776	0.3209	15.5888
4	0.0222	0.0289	30.4175	0.0219	0.0279	27.4562	0.0145	0.0207	42.7514	0.0821	0.0873	6.3227
16	0.0094	0.0103	9.5670	0.0092	0.0099	7.2450	0.0061	0.0069	13.7715	0.0318	0.0305	4.1451
48	0.0086	0.0069	19.9526	0.0084	0.0066	21.7434	0.0059	0.0046	23.2350	0.0252	0.0204	18.8676
80	0.0074	0.0073	0.4938	0.0072	0.0071	1.1853	0.0047	0.0052	9.3788	0.0190	0.0176	7.3234
100	0.0077	0.0069	10.2099	0.0074	0.0066	11.0743	0.0053	0.0044	16.1345	0.0214	0.0171	19.9169
116	0.0071	0.0086	20.6357	0.0068	0.0082	21.4604	0.0045	0.0058	30.0201	0.0198	0.0220	10.7866
148	0.0077	0.0092	19.0902	0.0074	0.0088	20.2121	0.0049	0.0062	28.0992	0.0218	0.0249	14.4810
180	0.0084	0.0093	10.0245	0.0081	0.0089	10.5871	0.0054	0.0065	21.0116	0.0225	0.0202	10.5287
200	0.0091	0.0085	7.3213	0.0087	0.0081	7.7047	0.0062	0.0054	13.6655	0.0243	0.0190	21.6890
216	0.0095	0.0090	5.3643	0.0091	0.0086	5.9248	0.0065	0.0057	12.0131	0.0249	0.0195	21.9947
	Mean		11.8379	Mean		11.1828	Mean		21.1269	Mean		11.5755

Table 11: Power measurements - LeNet5 within the STM32F746ZG. "Sig." stands for "Sigmoïde". Other LeNet5 topologies are with ReLU.

STM32F746ZG - Power [W]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.2	0.0306	0.0308	0.7371	0.0322	0.0308	4.3358	0.0308	0.0310	0.7151	0.0300	0.0310	3.3577
0.4	0.0310	0.0314	1.2713	0.0328	0.0317	3.4350	0.0314	0.0321	2.1107	0.0304	0.0321	5.6421
0.8	0.0312	0.0319	2.2297	0.0339	0.0325	4.2955	0.0324	0.0333	2.6629	0.0317	0.0334	5.3359
1	0.0255	0.0264	3.5258	0.0281	0.0273	2.7453	0.0266	0.0285	7.0813	0.0258	0.0286	11.1161
4	0.0310	0.0318	2.3622	0.0343	0.0348	1.6107	0.0327	0.0381	16.6197	0.0318	0.0384	20.8548
16	0.0511	0.0523	2.3312	0.0575	0.0555	3.4320	0.0559	0.0576	3.0268	0.0544	0.0577	6.0879
48	0.1113	0.1152	3.5178	0.1243	0.1115	10.2624	0.1231	0.1102	10.4210	0.1216	0.1102	9.4087
80	0.1443	0.1398	3.1234	0.1631	0.1590	2.4881	0.1629	0.1641	0.7549	0.1618	0.1643	1.5429
100	0.1714	0.1719	0.3073	0.1895	0.1955	3.1756	0.1881	0.2012	6.9803	0.1866	0.2014	7.9568
116	0.1920	0.1815	5.4570	0.2123	0.2217	4.4120	0.2121	0.2296	8.2456	0.2116	0.2299	8.6517
148	0.2484	0.2347	5.5177	0.2717	0.2821	3.8475	0.2715	0.2903	6.9379	0.2712	0.2906	7.1728
180	0.2924	0.2828	3.3111	0.3193	0.3517	10.1562	0.3198	0.3627	13.3951	0.3197	0.3631	13.5895
200	0.3193	0.3157	1.1390	0.3399	0.3790	11.4843	0.3380	0.3894	15.2281	0.3371	0.3898	15.6263
216	0.3328	0.3293	1.0409	0.3506	0.4050	15.5142	0.3487	0.4174	19.6911	0.3478	0.4178	20.1444
		Mean	2.5623		Mean	5.7996		Mean	8.1336		Mean	9.7491

STM32F746ZG - Power [W]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.2	0.0294	0.0312	5.8495	0.0304	0.0312	2.3999	0.0303	0.0314	3.6205	0.0317	0.0343	8.3325
0.4	0.0304	0.0324	6.6180	0.0311	0.0324	4.1875	0.0308	0.0328	6.5344	0.0319	0.0349	9.5837
0.8	0.0313	0.0339	8.2882	0.0322	0.0340	5.5544	0.0319	0.0349	9.4149	0.0317	0.0355	12.1264
1	0.0255	0.0294	15.4812	0.0265	0.0295	11.4321	0.0260	0.0307	18.2456	0.0270	0.0307	13.3984
4	0.0316	0.0402	27.2216	0.0327	0.0405	23.7012	0.0326	0.0428	31.2690	0.0337	0.0352	4.6869
16	0.0542	0.0586	8.0160	0.0557	0.0587	5.3388	0.0553	0.0595	7.6550	0.0560	0.0499	10.8287
48	0.1209	0.1098	9.1985	0.1234	0.1097	11.0525	0.1235	0.1094	11.3981	0.1149	0.1090	5.1773
80	0.1629	0.1657	1.7128	0.1650	0.1658	0.4622	0.1663	0.1669	0.3838	0.1337	0.1394	4.2736
100	0.1872	0.2030	8.4175	0.1882	0.2031	7.9498	0.1901	0.2044	7.4703	0.1744	0.1676	3.8757
116	0.2123	0.2319	9.2197	0.2140	0.2321	8.4651	0.2153	0.2337	8.5436	0.1865	0.1874	0.4729
148	0.2720	0.2926	7.5777	0.2734	0.2928	7.1254	0.2759	0.2944	6.6963	0.2417	0.2489	2.9693
180	0.3207	0.3657	14.0242	0.3215	0.3660	13.8288	0.3246	0.3681	13.3870	0.2787	0.3036	8.9286
200	0.3376	0.3924	16.2268	0.3375	0.3926	16.3314	0.3414	0.3946	15.5803	0.3181	0.3131	1.5707
216	0.3483	0.4208	20.8038	0.3485	0.4211	20.8435	0.3522	0.4235	20.2408	0.3307	0.3284	0.6825
		Mean	11.3325		Mean	9.9052		Mean	11.4600		Mean	6.2077

Table 12: Current measurements - LeNet5 within the STM32F746ZG. "Sig." stands for "Sigmoid". Other LeNet5 topologies are with ReLU.

STM32F746ZG - Current [mA]												
Freq. [MHz]	LeNet FP32 Sig.			LeNet FP32			LeNet FP32 50%			LeNet FP32 60%		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.2	9.2540	9.3222	0.7371	9.7545	9.3316	4.3358	9.3189	9.3855	0.7151	9.0846	9.3897	3.3577
0.4	9.3822	9.5015	1.2713	9.9181	9.5774	3.4350	9.5005	9.7010	2.1107	9.1918	9.7104	5.6421
0.8	9.4367	9.6471	2.2297	10.2645	9.8236	4.2955	9.8179	10.0793	2.6629	9.5869	10.0984	5.3359
1	7.7270	7.9994	3.5258	8.5048	8.2713	2.7453	8.0630	8.6340	7.0813	7.7944	8.6609	11.1161
4	9.3873	9.6091	2.3622	10.3684	10.5354	1.6107	9.8976	11.5426	16.6197	9.6068	11.6102	20.8548
16	15.4534	15.8137	2.3312	17.3843	16.7877	3.4320	16.9254	17.4377	3.0268	16.4696	17.4722	6.0879
48	33.6653	34.8496	3.5178	37.6014	33.7426	10.2624	37.2328	33.3528	10.4210	36.7980	33.3357	9.4087
80	43.6499	42.2865	3.1234	49.3344	48.1069	2.4881	49.2799	49.6519	0.7549	48.9580	49.7133	1.5429
100	51.8649	52.0243	0.3073	57.3308	59.1514	3.1756	56.9102	60.8827	6.9803	56.4588	60.9512	7.9568
116	58.0884	54.9185	5.4570	64.2338	67.0678	4.4120	64.1874	69.4800	8.2456	64.0316	69.5714	8.6517
148	75.1724	71.0246	5.5177	82.1982	85.3608	3.8475	82.1455	87.8447	6.9379	82.0514	87.9369	7.1728
180	88.4863	85.5565	3.3111	96.6110	106.4229	10.1562	96.7764	109.7397	13.3951	96.7180	109.8615	13.5895
200	96.6156	95.5151	1.1390	102.8529	114.6649	11.4843	102.2594	117.8316	15.2281	102.0088	117.9490	15.6263
216	100.6911	99.6430	1.0409	106.0949	122.5547	15.5142	105.5077	126.2833	19.6911	105.2244	126.4212	20.1444
	Mean		2.5623	Mean		5.7996	Mean		8.1336	Mean		9.7491

STM32F746ZG - Current [mA]												
Freq. [MHz]	LeNet FP32 70%			LeNet FP32 80%			LeNet FP32 90%			LeNet INT8		
	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]	Mes.	Est.	Diff. [%]
0.2	8.9061	9.4270	5.8495	9.2116	9.4327	2.3999	9.1595	9.4911	3.6205	9.5923	10.3916	8.3325
0.4	9.1869	9.7949	6.6180	9.4135	9.8077	4.1875	9.3281	9.9376	6.5344	9.6376	10.5613	9.5837
0.8	9.4820	10.2679	8.2882	9.7516	10.2932	5.5544	9.6386	10.5460	9.4149	9.5845	10.7468	12.1264
1	7.7056	8.8986	15.4812	8.0173	8.9339	11.4321	7.8518	9.2844	18.2456	8.1826	9.2789	13.3984
4	9.5672	12.1715	27.2216	9.9027	12.2497	23.7012	9.8752	12.9631	31.2690	10.1820	10.6592	4.6869
16	16.4117	17.7272	8.0160	16.8588	17.7589	5.3388	16.7314	18.0122	7.6550	16.9318	15.0983	10.8287
48	36.5839	33.2187	9.1985	37.3312	33.2052	11.0525	37.3626	33.1040	11.3981	34.7704	32.9703	5.1773
80	49.2780	50.1220	1.7128	49.9371	50.1679	0.4622	50.3095	50.5026	0.3838	40.4580	42.1870	4.2736
100	56.6395	61.4071	8.4175	56.9322	61.4582	7.9498	57.5334	61.8313	7.4703	52.7553	50.7107	3.8757
116	64.2483	70.1718	9.2197	64.7566	70.2382	8.4651	65.1521	70.7184	8.5436	56.4373	56.7041	0.4729
148	82.3018	88.5384	7.5777	82.7111	88.6046	7.1254	83.4900	89.0807	6.6963	73.1270	75.2984	2.9693
180	97.0449	110.6547	14.0242	97.2880	110.7418	13.8288	98.2182	111.3667	13.3870	84.3325	91.8622	8.9286
200	102.1413	118.7155	16.2268	102.1219	118.7999	16.3314	103.3108	119.4070	15.5803	96.2400	94.7284	1.5707
216	105.3954	127.3216	20.8038	105.4427	127.4207	20.8435	106.5638	128.1332	20.2408	100.0563	99.3734	0.6825
	Mean		11.3325	Mean		9.9052	Mean		10.7845	Mean		6.2077

Table 13: Latency measurements - ResNet8, FP32 within the STM32L496ZG

Frequency [MHz]	Latency [ms/inference]		Difference [%]
	Measures	Estimations	
0.1	4367133.61	5041285.43	15.44
0.2	1819775.60	2098631.66	15.32
0.4	841283.91	969895.42	15.29
0.8	405319.94	468263.19	15.53
1	321876.88	370469.26	15.10
2	158678.17	182501.62	15.01
4	78778.57	90605.01	15.01
8	39251.29	45142.82	15.01
16	19591.20	22553.42	15.12
24	13053.23	15027.83	15.13
32	9787.07	11269.74	15.15
48	6525.36	7516.73	15.19
64	4894.40	5646.56	15.37
80	3916.07	4522.96	15.50

Table 14: Energy consumption measurements - ResNet8, FP32 within the STM32L496ZG

Frequency [MHz]	Energy [J/inference]		Difference [%]
	Measures	Estimations	
0.1	2.1049	2.3824	13.1855
0.2	0.9641	1.0817	12.1989
0.4	0.5271	0.5834	10.6929
0.8	0.3312	0.3619	9.2736
1	0.2969	0.3193	7.5513
2	0.2215	0.2368	6.9222
4	0.1863	0.1957	5.0563
8	0.1681	0.1750	4.1082
16	0.1610	0.1671	3.7927
24	0.1575	0.1629	3.4235
32	0.1560	0.1612	3.3226
48	0.1542	0.1544	0.1027
64	0.1540	0.1568	1.8087
80	0.1533	0.1561	1.8634

Table 15: Power measurements - ResNet8, FP32 within the STM32L496ZG

Frequency [MHz]	Power [W]		Difference [%]
	Measures	Estimations	
0.1	0.000482	0.000473	1.9504
0.2	0.000530	0.000515	2.7095
0.4	0.000627	0.000602	3.9854
0.8	0.000817	0.000773	5.4148
1	0.000922	0.000862	6.5556
2	0.001396	0.001298	7.0352
4	0.002365	0.002160	8.6565
8	0.004282	0.003876	9.4788
16	0.008218	0.007410	9.8397
24	0.012064	0.010838	10.1660
32	0.015939	0.014302	10.2708
48	0.023630	0.020535	13.0997
64	0.031472	0.027773	11.7530
80	0.039135	0.034516	11.8046

Table 16: Current measurements - ResNet8, FP32 within the STM32L496ZG

Frequency [MHz]	Current [mA]		Difference [%]
	Measures	Estimations	
0.1	0.1458	0.1430	1.9504
0.2	0.1603	0.1560	2.7095
0.4	0.1896	0.1820	3.9854
0.8	0.2472	0.2338	5.4148
1	0.2790	0.2608	6.5556
2	0.4224	0.3926	7.0352
4	0.7155	0.6536	8.6565
8	1.2955	1.1727	9.4788
16	2.4866	2.2419	9.8397
24	3.6504	3.2793	10.1660
32	4.8227	4.3274	10.2708
48	7.1498	6.2132	13.0997
64	9.5227	8.4035	11.7530
80	11.8413	10.4434	11.8046

Table 17: Latency measurements - ResNet8, FP32 within the STM32F746ZG

Frequency [MHz]	Latency [ms/inference]		Difference [%]
	Measures	Estimations	
0.2	3912070.45	3373335.99	13.77
0.4	1555313.67	1372814.30	11.73
0.8	701435.59	628713.06	10.37
1	547523.59	436360.07	20.30
4	129452.38	103878.75	19.76
16	31927.93	25281.64	20.82
48	11177.69	8826.24	21.04
80	7110.65	7154.56	0.62
100	6040.08	5110.24	15.39
116	5198.33	5183.48	0.29
148	4367.24	4425.60	1.34
180	3859.81	4153.50	7.61
200	3669.16	3250.83	11.40
216	3586.86	3410.76	4.91

Table 18: Energy consumption - ResNet8, FP32 within the STM32F746ZG

Frequency [MHz]	Energy [J/inference]		Difference [%]
	Measures	Estimations	
0.2	116.304763	103.592899	10.9298
0.4	46.955766	43.005187	8.4134
0.8	21.581843	19.986107	7.3939
1.0	13.804069	11.502869	16.6704
4	3.924902	3.288920	16.2038
16	1.564295	1.317612	15.7696
48	1.201554	1.015495	15.4849
80	0.993320	0.988110	0.5245
100	1.008158	0.877052	13.0045
116	0.973075	0.930236	4.4025
148	1.088828	1.027916	5.5942
180	1.119826	1.164418	3.9820
200	1.166755	1.023766	12.2553
216	1.198475	1.120978	6.4663

Table 19: Power - ResNet8, FP32 within the STM32F746ZG

Frequency [MHz]	Power [W]		Difference [%]
	Measures	Estimations	
0.2	0.029730	0.030709	3.2951
0.4	0.030191	0.031326	3.7619
0.8	0.030768	0.031789	3.3178
1.0	0.025212	0.026361	4.5579
4	0.030319	0.031661	4.4258
16	0.048995	0.052117	6.3737
48	0.107496	0.115054	7.0313
80	0.139695	0.138109	1.1351
100	0.166911	0.171627	2.8249
116	0.187190	0.179462	4.1286
148	0.249317	0.232266	6.8392
180	0.290125	0.280346	3.3704
200	0.317990	0.314924	0.9639
216	0.334130	0.328660	1.6371

Table 20: Current - ResNet8, FP32 within the STM32F746ZG

Frequency [MHz]	Current [mA]		Difference [%]
	Measures	Estimations	
0.2	8.995377	9.291780	3.2951
0.4	9.134809	9.478456	3.7619
0.8	9.309562	9.618431	3.3178
1.0	7.628389	7.976084	4.5579
4	9.173759	9.579770	4.4258
16	14.824373	15.769239	6.3737
48	32.525172	34.812104	7.0313
80	42.267686	41.787904	1.1351
100	50.502694	51.929361	2.8249
116	56.638405	54.300049	4.1286
148	75.436394	70.277126	6.8392
180	87.783636	84.824957	3.3704
200	96.214694	95.287252	0.9639
216	101.098237	99.443127	1.6371

Table 21: Latency - ResNet8 pruned 70%, FP32 within the STM32F446ZE

Frequency [MHz]	Latency [ms/inference]		
	Measures	Estimations	Difference [%]
16	2724.63	3208.24	17.70
24	1815.23	2137.16	17.72
32	1361.17	1602.49	17.72
48	907.15	1067.98	17.73
64	680.33	800.91	17.73
80	544.21	640.68	17.75
90	483.72	569.41	17.73
100	435.39	512.58	17.73
116	375.32	441.82	17.73
124	351.15	413.29	17.72
132	329.86	388.32	17.71
148	294.19	346.28	17.71
164	265.52	312.49	17.72
180	241.92	284.76	17.69

Table 22: Energy consumption - ResNet8 pruned 70%, FP32 within the STM32F446ZE

Frequency [MHz]	Energy [J/inference]		
	Measures	Estimations	Difference [%]
16	0.0661	0.0656	0.7083
24	0.0495	0.0606	22.5107
32	0.0501	0.0530	5.8823
48	0.0430	0.0531	23.5410
64	0.0383	0.0413	7.8158
80	0.0362	0.0394	8.7565
90	0.0352	0.0381	8.2813
100	0.0337	0.0435	28.9996
116	0.0330	0.0424	28.4857
124	0.0363	0.0462	27.1566
132	0.0357	0.0458	28.2150
148	0.0372	0.0408	9.7628
164	0.0381	0.0403	5.7604
180	0.0368	0.0462	25.4580

Table 23: Power consumption - ResNet8 pruned 70%, FP32 within the STM32F446ZE

Frequency [MHz]	Power [W]		
	Measures	Estimations	Difference [%]
16	0.0243	0.0205	15.6951
24	0.0273	0.0284	4.0432
32	0.0368	0.0331	10.0741
48	0.0474	0.0497	4.9191
64	0.0563	0.0516	8.4604
80	0.0666	0.0615	7.6547
90	0.0728	0.0669	8.1513
100	0.0775	0.0848	9.4746
116	0.0881	0.0961	9.0537
124	0.1034	0.1117	7.9921
132	0.1086	0.1179	8.6299
148	0.1264	0.1178	6.8084
164	0.1439	0.1291	10.3133
180	0.1527	0.1621	6.1772

Table 24: Current consumption - ResNet8 pruned 70%, FP32 within the STM32F446ZE

Frequency [MHz]	Current [mA]		Difference [%]
	Measures	Estimations	
16	7.3407	6.1886	15.6951
24	8.2525	8.5862	4.0432
32	11.1345	10.0128	10.0741
48	14.3462	15.0519	4.9191
64	17.0405	15.5988	8.4604
80	20.1473	18.6051	7.6547
90	22.0399	20.2434	8.1513
100	23.4446	25.6659	9.4746
116	26.6510	29.0639	9.0537
124	31.2902	33.7909	7.9921
132	32.8527	35.6878	8.6299
148	38.2387	35.6352	6.8084
164	43.5449	39.0540	10.3133
180	46.2058	49.0600	6.1772