## **Table of Contents**

1.	Mot	ivatio	on and Introduction	6
	1.1.	Moti	vation / Introduction	6
	1.2.	Sco	pe of the work	6
2.	Intro	oduct	tion to the H.264 Video Encoder	9
	2.1.	The	H.264/AVC Video Encoder	9
	2.2.	Rate	e Distortion or Multimedia Transmission Problem	11
	2.3.	Dist	ortion measures	12
	2.4.	Lag	rangian Optimization Theory	13
3.	Rate	e-Dis	stortion-based Mode Decision	15
	3.1.	Inte	r Prediction in H.264	15
	3.2.	Intra	a Prediction	16
	3.2.	1.	Luma 4x4 Prediction Modes	16
	3.2.	2.	Luma 16x16 and Chroma 8x8 Prediction Modes	17
	3.2.	3.	I_PCM and Skip Mode	18
	3.3.	Mod	le Decision in H.264	18
	3.4.	Rela	ated Work	19
	3.5. Proposed Computational Complexity Control Scheme using an Early Mode-Prediction based on Image Statistics			
	3.6.	Ima	ge Statistics	22
	3.6.	1.	Analytical Case Study	22
	3.6.2.		Image Properties	26
	3.7.	Add	itional Parameters used by our Early Mode Prediction Algorithm	28
	3.8.	Prop	posed Mode Prediction	28
	3.8.	1.	Conditions/Constraints	28
	3.8.	2.	First-Level Decision for Early MB Type and Mode Prediction	32
	3.8.3.		P16x16 Exclusion (Second-Level Decision)	34
	3.8.4.		P16x16, P16x8, P8x16 and P8x8 Exclusion (Second-Level)	35
	3.8.5.		Sub-P8x8 Prediction (Second-Level)	36
	3.8.	6.	Skip Prediction	37
	3.9.	Thre	esholds & Adaption on QP	38
	3.10.	R	esults	41
4.	Rate	e Co	ntroller	52
	4.1.	Wha	at is Rate Control ?	52
	4.2.	Rate	e Control in H.264	53
	42	1	Frame Laver	54

	4.2.2. 4.2.3.		Basic Unit Layer	55
			Drawbacks	56
4	1.3.	Rel	ated Work	57
			erview of our Proposed Normalized PID-based Rate Controller exploiting Ima	_
4	1.5.	PID	Controller	59
	4.5	.1.	Introduction	59
	4.5	.2.	PID Control in Video Coding	60
4	1.6.	Fra	me Layer	60
	4.6.1.		Frame Layer Bit Allocation	60
	4.6	.2.	QP Calculation	61
	4.6.3.		Parameter Update	61
	4.6	.4.	PID Parameter Tuning	62
۷	1.7.	Bas	sic Unit – Macroblock Layer	63
	4.7	.1.	Image-Based QP Adjustments	64
	4.7	.2.	BU-PID Controller	65
	4.7	.3.	Optional Image-Quality QP Adaptations	66
4	4.8. Res		sults	67
	4.8.1.		Solely PID controller	68
	4.8.2.		Including Image-Based Decisions	71
	4.8.3.		RC Computational Costs	78
	4.8	.4.	Studying the Effect of Optional Image-Quality Decisions	78
5.	Dyr	nami	cally Scalable Coder Control	80
5	5.1. Intr		oduction	80
5	5.2. Rel		ated Work	81
5	5.3.	Ada	aptations	82
	5.3	.1.	Weighting Factors Adaptation	82
	5.3.2.		Forceful Exclusions	82
	5.3.3.		Image Statistics Prediction	84
	5.3	.4.	Bit Rate and Frame Rate Reduction	84
5	5.4. Rur		n-time Adaptive Power/Performance Aware Model	85
	5.4.1.		Battery Model	86
	5.4.2.		Power Aware Transitions	86
	5.4	.3.	Performance-Aware Transitions	87
5	5.5.	Res	sults	88
	5.5	.1.	Combined Computational Complexity and Rate Control	88
	5.5	2.	Run-time Adaptive Power Model	93

	5.5.	3.	Run-time Adaptive Performance Model	96
6.	Des	ignin	g Special Instructions for RISPP	97
(	6.1.	RIS	PP	97
(	6.2.	Spe	cial Instruction Design	97
(	6.3.	Edg	e Detection Special Instruction	98
(	6.4.	Area	a and Power Results	100
7.	Sum	nmar	y	102
	7.1.	Con	clusion	102
	7.2.	Futu	ıre Work	102
8.	App	endi	x	104
	8.1.	Ima	ge Statistics	104
	8.1.	1.	Brightness	104
	8.1.2.		Contrast	104
	8.1.3	3.	Variance	104
	8.1.	4.	Gradient	105
	8.1.	5.	Sobel Edge Detection	106
	8.1.	6.	Threshold Theory	108
į	8.2.	RIS	PP Atoms, Special Instructions and Molecules	108
	8.2.	1.	Brightness	108
	8.2.	2.	Contrast	109
	8.2.	3.	Gradient	110
	8.2.	4.	Variance	111
	8.3.	CES	S VideoAnalyzer	114
Re	ferend	ces /	Bibliography	115