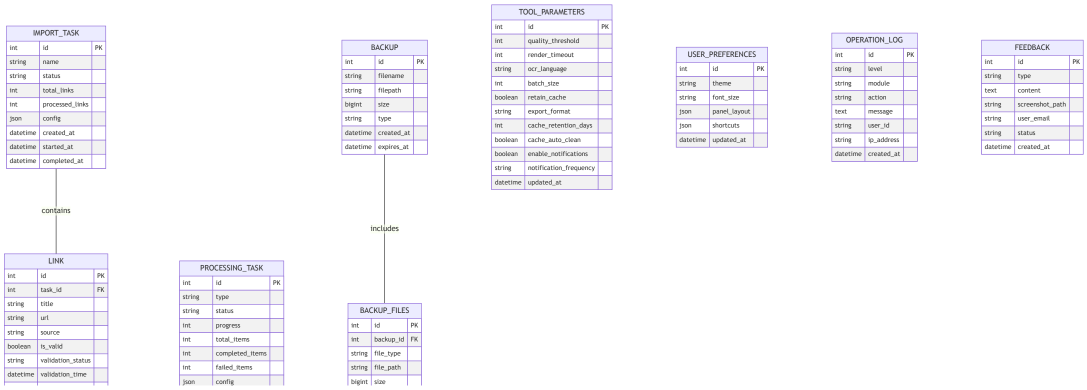
Database Schema (ERD)

Entity Relationship Diagram



IMPORT_TASK		
int	id	PK
string	name	
string	status	
int	total_links	
int	processed_links	
json	config	
datetime	created_at	
datetime	started_at	
datetime	completed_at	

BACKUP		
int	id	PK
string	filename	
string	filepath	
bigint	size	
string	type	
datetime	created_at	
datetime	expires_at	

TOOL_PARAMETERS		
int	id	PK
int	quality_threshold	
int	render_timeout	
string	ocr_language	
int	batch_size	
boolean	retain_cache	
string	export_format	
int	cache_retention_days	
boolean	cache_auto_clean	
boolean	enable_notifications	
string	notification_frequency	
datetime	updated_at	

USER_PREFERENCES		
int	id	PK
string	theme	
string	font_size	
json	panel_layout	
json	shortcuts	
datetime	updated_at	

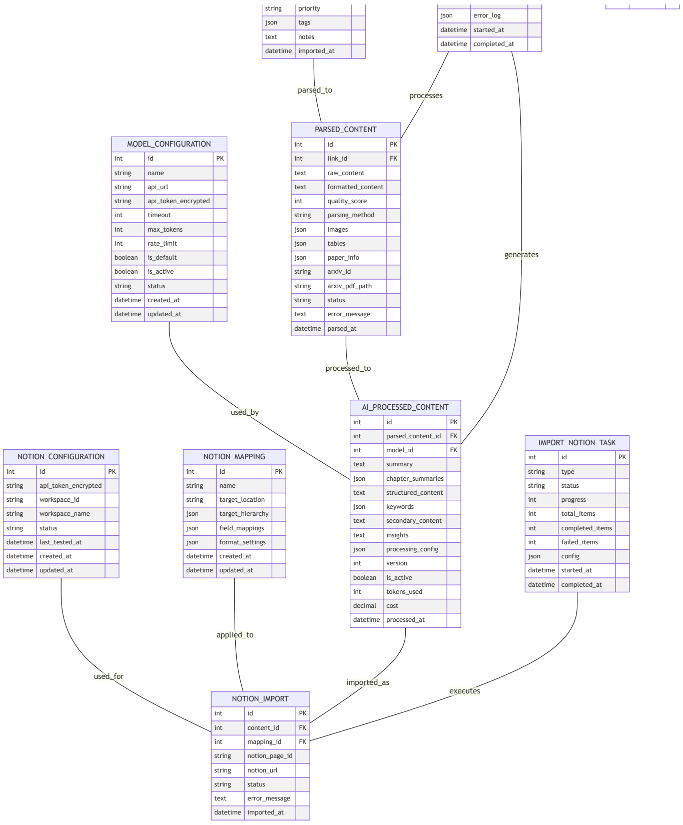
OPERATION_LOG		
int	id	PK
string	level	
string	module	
string	action	
text	message	
string	user_id	
string	ip_address	
datetime	created_at	

FEEDBACK		
int	id	PK
string	type	
text	content	
string	screenshot_path	
string	user_email	
string	status	
datetime	created_at	

LINK		
int	id	PK
int	task_id	FK
string	title	
string	url	
string	source	
boolean	is_valid	
string	validation_status	
datetime	validation_time	

PROCESSING_TASK		
int	id	PK
string	type	
string	status	
int	progress	
int	total_items	
int	completed_items	
int	failed_items	
json	config	

BACKUP_FILES		
int	id	PK
int	backup_id	FK
string	file_type	
string	file_path	
bigint	size	



string	priority	
json	tags	
text	notes	
datetime	imported_at	

json	error_log	
datetime	started_at	
datetime	completed_at	

PARSED_CONTENT

int	id	PK
int	link_id	FK
text	raw_content	
text	formatted_content	
int	quality_score	
string	parsing_method	
json	images	
json	tables	
json	paper_info	
string	arxiv_id	
string	arxiv_pdf_path	
string	status	
text	error_message	
datetime	parsed_at	

MODEL_CONFIGURATION

int	id	PK
string	name	
string	api_url	
string	api_token_encrypted	
int	timeout	
int	max_tokens	
int	rate_limit	
boolean	is_default	
boolean	is_active	
string	status	
datetime	created_at	
datetime	updated_at	

AI_PROCESSED_CONTENT

int	id	PK
int	parsed_content_id	FK
int	model_id	FK
text	summary	
json	chapter_summaries	
text	structured_content	
json	keywords	
text	secondary_content	
text	insights	
json	processing_config	
int	version	
boolean	is_active	
int	tokens_used	
decimal	cost	
datetime	processed_at	

IMPORT_NOTION_TASK

int	id	PK
string	type	
string	status	
int	progress	
int	total_items	
int	completed_items	
int	failed_items	
json	config	
datetime	started_at	
datetime	completed_at	

NOTION_CONFIGURATION

int	id	PK
string	api_token_encrypted	
string	workspace_id	
string	workspace_name	
string	status	
datetime	last_tested_at	
datetime	created_at	
datetime	updated_at	

NOTION_MAPPING

int	id	PK
string	name	
string	target_location	
json	target_hierarchy	
json	field_mappings	
json	format_settings	
datetime	created_at	
datetime	updated_at	

NOTION_IMPORT

int	id	PK
int	content_id	FK
int	mapping_id	FK
string	notion_page_id	
string	notion_url	
string	status	
text	error_message	
datetime	imported_at	

Table Details

Configuration Tables

1. model_configuration

Stores AI model configurations with encrypted credentials.

Column	Type	Description
id	INTEGER	Primary key
name	VARCHAR(100)	Model name (e.g., "GPT-4", "Claude 3")
api_url	VARCHAR(500)	API endpoint URL
api_token_encrypted	TEXT	Encrypted API token/key
timeout	INTEGER	Request timeout in seconds (default: 30)
max_tokens	INTEGER	Maximum tokens per request
rate_limit	INTEGER	API calls per minute limit
is_default	BOOLEAN	Whether this is the default model
is_active	BOOLEAN	Whether model is active
status	VARCHAR(50)	Connection status (online/offline/error)
created_at	TIMESTAMP	Creation timestamp
updated_at	TIMESTAMP	Last update timestamp

Indexes:

- PRIMARY KEY (id)
- INDEX (is_default, is_active)

2. notion_configuration

Stores Notion API configuration.

Column	Type	Description
id	INTEGER	Primary key
api_token_encrypted	TEXT	Encrypted Notion API token
workspace_id	VARCHAR(100)	Notion workspace ID
workspace_name	VARCHAR(200)	Workspace display name
status	VARCHAR(50)	Connection status
last_tested_at	TIMESTAMP	Last connection test time
created_at	TIMESTAMP	Creation timestamp
updated_at	TIMESTAMP	Last update timestamp

Indexes:

- PRIMARY KEY (id)

3. tool_parameters

Global tool configuration parameters.

Column	Type	Description
id	INTEGER	Primary key (singleton, always id=1)
quality_threshold	INTEGER	Parsing quality threshold (0-100)
render_timeout	INTEGER	Web page render timeout (seconds)
ocr_language	VARCHAR(20)	OCR language (en/zh/auto)
batch_size	INTEGER	Import batch size
retain_cache	BOOLEAN	Whether to retain local cache
export_format	VARCHAR(20)	Default export format (excel/pdf)
cache_retention_days	INTEGER	Cache retention period (days)
cache_auto_clean	BOOLEAN	Auto-clean cache
enable_notifications	BOOLEAN	Enable notifications
notification_frequency	VARCHAR(20)	Notification frequency
updated_at	TIMESTAMP	Last update timestamp

4. user_preferences

User interface preferences.

Column	Type	Description
id	INTEGER	Primary key (singleton, always id=1)
theme	VARCHAR(20)	UI theme (light/dark/system)
font_size	VARCHAR(20)	Font size (small/medium/large)
panel_layout	JSON	Hidden panel configuration
shortcuts	JSON	Custom keyboard shortcuts
updated_at	TIMESTAMP	Last update timestamp

Link Management Tables

5. import_task

Import task records.

Column	Type	Description
id	INTEGER	Primary key
name	VARCHAR(200)	Task name
status	VARCHAR(50)	Task status (pending/running/completed/failed)
total_links	INTEGER	Total number of links
processed_links	INTEGER	Number of processed links
config	JSON	Task configuration (scope, parameters)
created_at	TIMESTAMP	Creation timestamp
started_at	TIMESTAMP	Start timestamp
completed_at	TIMESTAMP	Completion timestamp

Indexes:

- PRIMARY KEY (id)
- INDEX (status, created_at)

6. link

Imported links with metadata.

Column	Type	Description
id	INTEGER	Primary key
task_id	INTEGER	Foreign key to import_task
title	VARCHAR(500)	Link title
url	TEXT	Full URL
source	VARCHAR(50)	Source type (favorites/manual/history)
is_valid	BOOLEAN	Whether URL is valid
validation_status	VARCHAR(50)	Validation result (200/404/500/timeout)
validation_time	TIMESTAMP	Validation timestamp
priority	VARCHAR(20)	Priority level (high/medium/low)
tags	JSON	Array of tags
notes	TEXT	User notes
imported_at	TIMESTAMP	Import timestamp

Indexes:

- PRIMARY KEY (id)
- FOREIGN KEY (task_id) REFERENCES import_task(id)
- INDEX (url(255)) - For deduplication
- INDEX (is_valid, status)

Content Processing Tables

7. parsed_content

Parsed content from links.

Column	Type	Description
id	INTEGER	Primary key
link_id	INTEGER	Foreign key to link
raw_content	TEXT	Raw extracted content
formatted_content	TEXT	Cleaned and formatted content
quality_score	INTEGER	Parsing quality score (0-100)
parsing_method	VARCHAR(50)	Method used (html/pdf/ocr)
images	JSON	Array of extracted images
tables	JSON	Array of extracted tables
paper_info	JSON	Extracted paper metadata
arxiv_id	VARCHAR(50)	arXiv paper ID
arxiv_pdf_path	VARCHAR(500)	Local path to downloaded PDF
status	VARCHAR(50)	Parsing status
error_message	TEXT	Error details if failed
parsed_at	TIMESTAMP	Parsing timestamp

Indexes:

- PRIMARY KEY (id)
- FOREIGN KEY (link_id) REFERENCES link(id)
- INDEX (status, quality_score)
- INDEX (arxiv_id)

8. ai_processed_content

AI-processed content with versions.

Column	Type	Description
id	INTEGER	Primary key
parsed_content_id	INTEGER	Foreign key to parsed_content
model_id	INTEGER	Foreign key to model_configuration
summary	TEXT	Overall summary
chapter_summaries	JSON	Chapter-by-chapter summaries
structured_content	TEXT	Restructured content
keywords	JSON	Extracted keywords and tags
secondary_content	TEXT	Secondary creation content
insights	TEXT	Generated insights
processing_config	JSON	Processing parameters used
version	INTEGER	Content version number
is_active	BOOLEAN	Whether this is the active version
tokens_used	INTEGER	Total tokens consumed
cost	DECIMAL(10,4)	Estimated cost
processed_at	TIMESTAMP	Processing timestamp

Indexes:

- PRIMARY KEY (id)
- FOREIGN KEY (parsed_content_id) REFERENCES parsed_content(id)
- FOREIGN KEY (model_id) REFERENCES model_configuration(id)
- INDEX (parsed_content_id, version)
- INDEX (is_active)

9. processing_task

Background processing task records.

Column	Type	Description
id	INTEGER	Primary key
type	VARCHAR(50)	Task type (parsing/ai_processing)
status	VARCHAR(50)	Task status
progress	INTEGER	Progress percentage (0-100)
total_items	INTEGER	Total items to process
completed_items	INTEGER	Completed items
failed_items	INTEGER	Failed items
config	JSON	Task configuration
error_log	JSON	Array of error records
started_at	TIMESTAMP	Start timestamp
completed_at	TIMESTAMP	Completion timestamp

Indexes:

- PRIMARY KEY (id)
- INDEX (type, status)

Notion Integration Tables

10. notion_mapping

Field mapping configurations.

Column	Type	Description
id	INTEGER	Primary key
name	VARCHAR(200)	Mapping template name
target_location	VARCHAR(200)	Notion page/database ID
target_hierarchy	JSON	Hierarchy path
field_mappings	JSON	Source-to-target field mappings
format_settings	JSON	Format options
created_at	TIMESTAMP	Creation timestamp
updated_at	TIMESTAMP	Last update timestamp

Indexes:

- PRIMARY KEY (id)
- INDEX (name)

11. notion_import

Import records to Notion.

Column	Type	Description
id	INTEGER	Primary key
content_id	INTEGER	Foreign key to ai_processed_content
mapping_id	INTEGER	Foreign key to notion_mapping
notion_page_id	VARCHAR(200)	Created Notion page ID
notion_url	TEXT	Notion page URL
status	VARCHAR(50)	Import status
error_message	TEXT	Error details if failed
imported_at	TIMESTAMP	Import timestamp

Indexes:

- PRIMARY KEY (id)

- FOREIGN KEY (content_id) REFERENCES ai_processed_content(id)
- FOREIGN KEY (mapping_id) REFERENCES notion_mapping(id)
- INDEX (notion_page_id)
- INDEX (status)

12. import_notion_task

Notion import task records.

Column	Type	Description
id	INTEGER	Primary key
type	VARCHAR(50)	Task type (import/sync)
status	VARCHAR(50)	Task status
progress	INTEGER	Progress percentage
total_items	INTEGER	Total items
completed_items	INTEGER	Completed items
failed_items	INTEGER	Failed items
config	JSON	Task configuration
started_at	TIMESTAMP	Start timestamp
completed_at	TIMESTAMP	Completion timestamp

Indexes:

- PRIMARY KEY (id)
- INDEX (type, status)

System Management Tables

13. backup

Backup metadata records.

Column	Type	Description
id	INTEGER	Primary key
filename	VARCHAR(500)	Backup file name
filepath	VARCHAR(1000)	Full file path
size	BIGINT	Backup size in bytes
type	VARCHAR(20)	Backup type (manual/auto)
created_at	TIMESTAMP	Creation timestamp
expires_at	TIMESTAMP	Expiration timestamp

Indexes:

- PRIMARY KEY (id)
- INDEX (created_at, type)

14. backup_files

Individual files in backup.

Column	Type	Description
id	INTEGER	Primary key
backup_id	INTEGER	Foreign key to backup
file_type	VARCHAR(50)	File type (database/cache/upload)
file_path	VARCHAR(1000)	Relative file path
size	BIGINT	File size in bytes

Indexes:

- PRIMARY KEY (id)
- FOREIGN KEY (backup_id) REFERENCES backup(id) ON DELETE CASCADE

15. operation_log

System operation logs.

Column	Type	Description
id	INTEGER	Primary key
level	VARCHAR(20)	Log level (info/warning/error)
module	VARCHAR(100)	Module name
action	VARCHAR(200)	Action performed
message	TEXT	Log message
user_id	VARCHAR(100)	User identifier
ip_address	VARCHAR(50)	Request IP address
created_at	TIMESTAMP	Log timestamp

Indexes:

- PRIMARY KEY (id)
- INDEX (level, created_at)
- INDEX (module, action)

16. feedback

User feedback records.

Column	Type	Description
id	INTEGER	Primary key
type	VARCHAR(50)	Feedback type (bug/feature/other)
content	TEXT	Feedback content
screenshot_path	VARCHAR(500)	Screenshot file path
user_email	VARCHAR(200)	User email
status	VARCHAR(50)	Status (new/reviewed/resolved)
created_at	TIMESTAMP	Creation timestamp

Indexes:

- PRIMARY KEY (id)

- INDEX (type, status, created_at)

Database Migrations

Migration Strategy

- Use **Alembic** for database migrations
- Version control for schema changes
- Rollback support for failed migrations

Initial Migration

```
# migrations/versions/001_initial_schema.py
# Create all base tables with proper constraints
```

Sample Migration Commands

```
# Create a new migration
alembic revision -m "description"

# Upgrade to latest
alembic upgrade head

# Downgrade one version
alembic downgrade -1

# Show current version
alembic current
```

Data Relationships Summary

One-to-Many Relationships

- `import_task` → `link` (1:N)
- `link` → `parsed_content` (1:1, but modeled as 1:N for flexibility)
- `parsed_content` → `ai_processed_content` (1:N, versioning)

- `notion_mapping` → `notion_import` (1:N)
- `backup` → `backup_files` (1:N)

Many-to-One Relationships

- `ai_processed_content` → `model_configuration` (N:1)
- `notion_import` → `notion_configuration` (N:1, implicit)

Data Flow

1. Links imported → `link` table
2. Links parsed → `parsed_content` table
3. Content processed by AI → `ai_processed_content` table
4. Content imported to Notion → `notion_import` table

Database Optimization Considerations

Indexes

- Created on frequently queried columns
- Foreign keys automatically indexed
- Composite indexes for common filter combinations

Partitioning (Future)

- Partition `operation_log` by date (monthly)
- Partition `backup` by year

Archival Strategy

- Archive old logs beyond retention period
- Archive completed tasks older than 6 months
- Keep import records for audit trail

Performance

- Use connection pooling
- Implement query result caching

- Use batch operations for bulk inserts
- Optimize JSON field queries with indexes